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## PREFACE.

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THE great success of the first edition of this little volume, and the high eulogiums bestowed on it by its generous patrons, have induced me to bring out a New Edition, which I have taken great pains to render still more worthy of approbation, by several important additions, and a most careful revision. The book itself also is now presented in a more convenient form, and much improved in outward appearance, type, &c., without any increase in price. I wish especially to direct the attention of Parents and Teachers to the necessity of possessing a work calculated to save them much fatigue in the responsible office of education. The subjects contained in it may seem in themselves unimportant or insignificant; but do not children often ask a variety of questions on these very subjects, at times when the parent or teacher is not at leisure to answer them properly?—questions on the most simple subjects, asked in such a manner as to puzzle the cleverest! Besides, is there *one* thing used by us in the daily business of life without its historical interest? Decidedly not,—although, from their familiarity, many are passed by as unimportant. I consider that to trace them to their source is not only amusing, but highly instructive, for there is scarcely one which is not connected with some epoch important in the history of the world.

Here, then, is a book which, I flatter myself, will answer every purpose, as it can be instantly referred to for the required answer, by means of the Index. It is very necessary that children should know the construction of things in common use; the wonders of the natural world; and the manner in which the productions of the earth are made subservient to the use of man;—for,

without this, their knowledge is only superficial. How should children acquire this knowledge, unless their questions obtain clear and intelligent answers? Another advantage also (and for which I have received the commendation of many able teachers) is, the insertion of the meaning of the most difficult words or terms occurring in each answer, at the end of it,—thereby saving the trouble of explanation or reference to a dictionary; both of which are too apt, for want of time, to be passed over, especially in large seminaries, where everything is obliged to be done with despatch.

There may be other works on a similar plan; but the subjects have not been carried out so minutely as in the one now presented, which embraces their whole history, and traces their different stages of improvement, &c., History, Geography, Arts and Sciences, Manufactures, Productions of the Animal, Vegetable, and Mineral Kingdoms, and the Wonders of the Elements, are here exhibited in an engaging aspect. Youth is fond of novelty; and every day there is some new work published:—surely, then, I may hope that mine may take no mean place among them; and its object will be accomplished if it increase the stock of knowledge in the minds of young people.

---

The former editions of this work being all circulated, and the American press having published the same with a few additions, it was thought advisable to add them to the present New Edition, which has not only been carefully revised, but extended much further, by embracing several subjects of a recent date.

E. E. W.

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# A CATECHISM

OF

## FAMILIAR THINGS.

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### CHAPTER I.

DEW, HONEY-DEW, WATER, RAIN, SNOW, HAIL, ATMOSPHERE, WIND, LIGHTNING, THUNDER, ELECTRICITY, TWILIGHT, AND THE AURORA BOREALIS.

What is Dew ?

A moist vapour drawn by the sun from the earth and water, and condensed or thickened ; this very light, thin, insensible mist again falls, while the sun is below the horizon. Dews are more copious in the spring and autumn than at any other season ; in warm countries than in cold ones : because, where the days are extremely hot, the nights are remarkably cold, so that the vapours which rise after sunset are readily condensed into dews. Egypt abounds in dews all the summer ; for the air being too hot to condense the vapours in the day-time, they never gather into clouds, and hence there is no rain there.

*Horizon*, the line which bounds the view on all sides, so that the earth and sky appear to meet. A Greek word, from the verb signifying to mark boundaries.

What is its use ?

It cools and refreshes the vegetable creation, and prevents it from being destroyed by the heat of the sun. All hot countries where there is little or no rain are therefore blessed with this provision by the all-bountiful Creator, to render them luxuriant and inhabitable ; and the dews which fall are so copious, that the earth is as deeply soaked

with them during the night as if a heavy rain had fallen. For this reason also it is, that we so often read in the Bible of the "dew of heaven" being promised to the Israelites as a signal favour.

*Luxuriant*, fertile, flourishing. *Signal*, remarkable, particular.

From what does the vapour originate?

Vapour is water, combined with a still greater quantity of caloric—that is, heat,—which causes it to take the gaseous form.\*

*Gaseous*, consisting of gas.

From whence is the word dew derived?

From a Greek word, signifying to moisten.

Is there not a dew found covering the leaves of plants?

Yes; Honey-dew. It is caused by Aphides, insects which suck the juices of plants; and after digesting them, eject the remainder over the leaves.

What is Water?

The fluid body which composes more than two-thirds of our globe; and which is necessary for the life and health of the animal and vegetable creation; for without water there would be neither rain nor dew, and everything would perish for want of moisture. It is likewise a necessary beverage for man and other animals.

*Beverage*, drink, liquor to be drunk in general.

In how many states do we find water?

In four: solid or ice; liquid or water; vapour or steam; and in a state of union with other bodies. Its most simple state is that of ice, which is water deprived of a certain portion of its caloric or heat: crystallisation then takes place, and the water becomes solid and is called ice.

*Crystallisation*, reduced to the state of crystal, a hard, transparent stone: by this term is understood the hardening of certain substances into regular forms, occasioned by the loss of a portion of their caloric.

From what cause is the water deprived of its caloric?

From the coldness of the atmosphere: underneath the poles of our globe it is eternally solid; there it is similar to the hardest rocks, and may be cut by the chisel, like

\* See Chapter xiii., article Oxygen.

stone or marble. This great solidity is occasioned by the low temperature of the surrounding air; and in very cold countries ice may be ground so fine as to be blown away by the wind, and will be still ice.

*Poles*, the extremities or ends of the axis, an imaginary line supposed to be drawn through the middle of the earth; or when applied to the heavens, the two points directly over them. *Temperature*, degree of heat or cold in the air.

Is ice the only instance of water existing in a state of solidity?

No; it is combined in a solid state in marble,\* stones of all kinds, and in all vegetable and earthy salts; to all of which it imparts hardness, and to most of them transparency. Water is also still more solid in the mortars† and cements used in building, having parted with more of its caloric in that combination than it does in the act of freezing.

What effect has the presence of water upon stones and salts?

They lose clearness and solidity by being deprived of a part only of the water which they contain. It is by a union with water that some of the gases are rendered liquid substances, and that some liquids acquire the property of becoming fixed or solid. Water is not only employed in dissolving solid substances, but has important uses in a variety of compounds.

*Transparency*, clearness. *Combination*, state of union with others. *Compound*, a mixture of different substances.

Does Nature decompose water in any of her operations?

Yes; every living vegetable has the power of decomposing water, by a secret process peculiar to itself. Fish too, and all cold-blooded amphibious animals are gifted with the same power.

*Decomposing*, separating a mixed body into its several parts. *Amphibious*, able to live both in water and out of it.

Of what use is this power to vegetables?

The water which they decompose affords them nourishment for the support of their vital juices, and enables

\* See Chapter xiii., article Oxygen.

† Ditto.

them, by combining the fluid gases which compose it with those of the air and the soil, to form their different products; while the superfluous gas is abundantly given out by their leaves, to refresh the spent air and render it wholesome for the animals which breathe it.

*Vital*, belonging to life, necessary to existence. *Superfluous*, unnecessary, not wanted.

### What is Rain?

The condensed drops of the aqueous vapours raised in the atmosphere by the sun and wind, converted into clouds, which fall in rain, snow, hail, or mist: their falling is occasioned by a collision produced by contrary currents of wind, or from the clouds passing into a colder part of the air.

### What effect does the wind or cold produce?

By acting quickly upon the particles of air before they arrive at any considerable height, the drops become proportionately small, and dew is formed. If the vapours are more copious, and rise a little higher, they form a mist or fog, which, unlike dew, is visible to the eye; higher still they produce rain. Hence we may account for the changes of the weather: why a cold summer is always a wet one—a warm, a dry one.

*Aqueous*, watery; consisting of water. *Collision*, a striking together, a clash, a meeting. *Particles*, any small portions of a greater substance.

### What seasons are more liable to rain than others?

The spring and autumn are generally the most rainy seasons; the vapours *rise* more plentifully in spring; and in the autumn, as the sun recedes from us and the cold increases, the vapours that lingered above us during the summer heats *fall* more easily.

*Recede*, to fall back, to retreat.

### What is Snow?

Rain congealed by cold in the atmosphere, which causes it to fall to the earth in white flakes. Snow fertilises the ground by defending the corn and other vegetables from the intenser cold of the air and the piercing winds.

*Congealed*, turned by the force of cold from a fluid to a solid state; hardened. *Fertilise*, to render fruitful. *Intenser*, raised to a higher degree, strained, forced, more powerful.



### What is Hail ?

Drops of rain frozen in their passage through the middle-region of the air. Hail assumes various figures according to the degrees of heat or cold through which it passes, being sometimes round, flat, &c.

### What is the Atmosphere ?

The thin, light, fluid, elastic body, which encompasses the earth on all sides : it extends fifty miles above the surface of the earth, where it is thinner than at a small distance from it. Air is the fluid gas of which it is composed.

*Fluid*, anything not solid, as water, and all liquids. *Elastic*, having the power of springing ; yielding, giving way.

### What are its uses ?

It is necessary to the well-being of man, since without it neither he nor any animal, insect, or vegetable could exist. If it were not for atmospheric air, we should be unable to converse with each other ; we should know nothing of sound or smell, or of the pleasures which arise from the variegated prospects which surround us : it is to the presence of air that water owes its agreeable taste. Boiling deprives it of the greater part ; hence the flat, insipid taste of boiled water.

*Variegated*, diversified, changed ; adorned with different colours. *Insipid*, tasteless.

### What is Wind ?

A violent motion of the air caused by its being thinner in one part than another, or by a tract of atmosphere moving from one place to another. The chief cause of this motion is the sun's heat, called solar heat, which causes the air to rise. Cooler air then rushes into the space created, and forms the current called wind.

### How are the winds distinguished ?

There are winds which always blow in one direction ; others which blow six months one way and six months from a contrary point, according to the position of the sun ; and variable winds, blowing sometimes one way and sometimes another. There are likewise land and sea breezes ; and the sudden and violent concussions of atmospheric air, called storms, as the whirlwind, hurricane, &c. ;

also the four principal winds of the north, south, east, and west.

*Concussion*, a violent striking or clashing of bodies against each other.

What is Lightning?

The effects of electricity in the clouds. A flash of lightning is simply a stream of the electric fluid passing from the clouds to the earth, from the earth to the clouds, or from one cloud to another. Lightning usually strikes the highest and most pointed objects, as high hills, trees, spires, masts of ships, &c.

What is Thunder?

The report and the echoes of the report which accompany the electrical union of the clouds: or the echoes of the report between them and the earth. Thunder is produced by a sudden discharge of electrical matter collected in the air, by which vibrations or sounds are produced, with reflections or echoes from the clouds and earth.

What is Electricity?

One of those agents passing through the earth and all substances, without giving any outward signs of its presence, when at rest; yet when active, often producing violent and destructive effects. It is *supposed* to be a highly elastic fluid, capable of moving through matter; and clouds owe to it their form and existence.

What bodies does it pass through?

Through all substances, but more easily through metals, water, the human body, &c., which are called conductors, than through air, glass, and silk, which are called *non-conductors*. When bodies are not surrounded with non-conductors, the electricity escapes quickly into the earth, hence buildings can be protected in some measure from the direful effects of lightning by metal conductors in the form of a cylinder being placed upon them, so as to communicate with the earth, and thus conduct away the discharge.

To what part of bodies is electricity confined?

To their surfaces, as the outside may be electric, and the inside in a state of neutrality. The heat produced by an electric shock is very powerful, but is only accompanied by light when the fluid is obstructed in its passage.

The production and condensation of vapour is a great source of the atmospheric electricity.

*Condensation*, the act of thickening any body or making it more weighty.

In what other sense is the term electricity employed ?

This term is also employed to designate that important branch of knowledge which relates, to those properties shown by certain bodies when rubbed against, or otherwise brought in contact with each other, to attract substances, and emit sparks of fire.

*Designate*, to point out by some particular token. *Emit*, to send forth, to throw out.

Whence is the word derived ?

From *electron*, the Greek word for amber, a yellow transparent substance, remarkable for its electrical power when rubbed : amber is of a resinous nature, and is collected from the sea-shore, or dug from the earth, in many parts of the world. It is employed in the manufacture of beads and other toys, on account of its transparency ; is of some use in medicine, and in the making of varnishes.

*Amber*, a fossil resin, the product of some ancient *coniferous* tree. The fact of insects of an extinct race being frequently found embedded within it, is a corroboration of the fact. *Transparent*, clear, capable of being seen through. *Resinous*, containing resin, a gummy vegetable juice.

Name a few substances possessing this remarkable property.

Silks of all kinds are highly electric ; the hair and fur of animals, paper, sulphur, and some other minerals ; most of the precious stones ; the paste of which false gems are made ; and many other substances used by us in the common affairs of life, are susceptible of electrical excitement ; among domestic animals the cat furnishes a remarkable instance of this fact.

*Electric*, having the properties of electricity. *Susceptible*, disposed to admit easily.

How so ?

Because, when dry and warm, the back of almost any full-grown cat (the darker its colour the better) can be excited by rubbing it with the hand in the direction of the hair, a process which is accompanied with a slight snapping noise, and in the dark by flashes of pale blue light.

Give another example.

A piece of glass rubbed with silk, or a stick of red sealing wax rubbed with woollen cloth, acquires the property of attracting and repelling feathers, straws, threads of cotton, and other light substances; the substances just mentioned as highly electric are, however, merely specimens; all substances, probably, are capable of being electrically excited; but some require more complicated contrivances to produce it than others.\*

*Repelling*, the act of driving back. *Complicated*, formed by the union of several parts in one.

Is there not a machine by which we are enabled to obtain large supplies of electric power at pleasure?

Yes; the electrical machine. It is made of different forms and sizes: for common purposes those of the simplest form are the best.

Of what does this machine usually consist?

Of a cylinder of glass fixed on glass pillars firmly secured to a piece of hard wood; the cylinder is mounted on these pillars, between which it turns round on an axis at each end, by means of a handle attached to one of its axes. Two hollow cylinders of metal (also fixed on glass pillars) are called *conductors*, because they convey the electric power to any body in contact with them; to one of these is fastened a cushion or rubber of soft leather, stuffed with wool; to the other (which is called the *prime conductor*), a row of fine steel points. The cushion is nearly as long as the glass cylinder, and is made to press equally and gently against it by means of a slender metal spring at the back; but the prime conductor is so arranged as to approach as close as possible, but *without* touching it. To the upper side of the cushion is sewn a piece of stout green or black silk, slightly stiffened by being oiled; this flap extends from the rubber, across the glass cylinder. Before the machine is set in motion, the cushion is spread over with a mixture of quicksilver and tin, copper, &c., to increase its electrical effect. This mixture is called *amalgam*.

*Cylinder*, a body having two flat sides, and one circular, something like a roller.

\* See Galvanism, Chapter xii.

What effect is produced by turning the handle of the cylinder ?

After the machine has been properly arranged for the purpose of using it, if the handle is turned, and the room be darkened, flashes of pale white light will be seen to issue from between the cylinder and the rubber, which, passing underneath the silk will illuminate the points on the side (or end) of the prime conductor ; if the hand is then held to it, sparks will pass from it in rapid succession, producing a sharp, snapping sound, and causing in the hand a sensation of pain.

What is this called ?

An *electric shock* ; it is caused by the electric fluid passing through the hand and occasioning a sudden motion by the contraction of the muscles through which it passes. The force of the shock is in proportion to the power of the machine by which it is given.

What are the muscles ?

Bundles of thin fleshy fibres, or threads, fastened to the bones of animals, the contraction and expansion of which move the bones or perform the organic functions of life.

*Organic*, relating to organs or instruments, that is, various parts acting together, to a certain end. *Functions*, employments or offices of any part of the body. *Contraction*, drawing in or shortening. *Expansion*, extending or spreading out.

Has not the knowledge of electricity been of great service to mankind ?

The knowledge of its effects and the laws by which it is governed has been of great value ; for they have not only been able to secure their property from its destructive power, but to employ it for many useful purposes in the arts.

What is Twilight ?

The time from the first dawning of day to the rising of the sun ; and again between its setting and the last remains of day. Without twilight, the sun's light would appear at its rising, and disappear at its setting instantaneously ; and we should experience a sudden transition from the brightest sunshine to the profoundest obscurity. The duration of twilight is different in different climates ; and

in the same places it varies at different periods of the year.

*Instantaneously*, done in an instant, in a moment's time. *Obscurity*, darkness, want of light.

How is it produced?

By the sun's refraction—that is, the variation of the rays of light from their direct course, occasioned by the density of the atmosphere.

*Variation*, change. *Density*, thickness.

What is the poetical name for the morning twilight?

Aurora, the goddess of the morning, and harbinger of the rising sun: whom poets and artists represent as drawn by white horses in a rose-coloured chariot, unfolding with her rosy fingers the portals of the East, pouring reviving dew upon the earth, and reanimating plants and flowers.

*Harbinger*, a fore-runner. *Portals*, gates, doors of entrance. *Re-animating*, bringing to life.

What remarkable phenomenon is afforded to the inhabitants of the polar regions?

The Aurora Borealis, or Northern Lights, a luminous appearance in the northern parts of the heavens, seen mostly during winter, or in frosty weather, and clear evenings; it assumes a variety of forms and hues, especially in the polar regions, where it appears in its perfection, and proves a great solace to the inhabitants amidst the gloom of their long winter's night, which lasts from one to six months, while the summer's day which succeeds it lasts in like manner for the same period of time.

Of what nature is the Aurora Borealis?

It is decidedly an electrical phenomenon which takes place in the highest regions of the atmosphere. It is somehow connected with the magnetic poles of the earth; and generally appears in form of a luminous arch, from east to west, but never from north to south.

*Phenomenon*, an extraordinary appearance in the heavens or earth whose cause is unknown. The word is from a Greek one, signifying, to show, or appear. *Magnetic*, belonging to the magnet, or loadstone. *Luminous*, bright, shining.

In what country is it seen constantly from October to Christmas?

In Siberia, where it is remarkably bright. On the western coast of Hudson's Bay, in North America, the sun no sooner disappears, than the Aurora Borealis diffuses a thousand different lights and colours with such dazzling beauty, that even the full moon cannot eclipse it.

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## CHAPTER II.

CORN, BARLEY, PEARL BARLEY, OATS, RYE, POTATOES, TEA, COFFEE, AND CHOCOLATE.

What is Corn ?

Corn signifies a race of plants which produce grain in an ear or head, fit for bread, the food of man, or the grain or seed of the plant, separated from the ear.

What is generally meant by corn ?

Wheat ; but the farmer ranks under the name of corn several other grains, as rye, oats, barley, &c.

Where was corn first used ?

It is uncertain. The Athenians pretend that it was amongst them it was first used ; the Cretans, Sicilians, and Egyptians also lay claim to the same. From the accounts in the Bible, we find that its culture engaged a large share of the attention of the ancient Hebrews.

*Culture, growth, cultivation. Hebrews, the children of Israel, the Jews.*

Who were the Athenians ?

Inhabitants of Athens, the capital city of Greece.

Who were the Cretans ?

The inhabitants of Crete, an island of the Archipelago.

Who were the Sicilians ?

Inhabitants of Sicily, an island situated in the Mediterranean Sea, close to the foot of Italy, and separated only by a narrow strait.

Where do the Egyptians dwell ?

In Egypt, a country of Africa. It is extremely fertile, producing great quantities of corn. In ancient times it was called the dry nurse of Rome and Italy, from its furnishing with it a considerable part of the Roman Empire : and we are informed, both from sacred and profane

history, that it was anciently the most fertile in corn of all countries of the world. The corn of Syria has always been very superior, and by many classed above that of Egypt.

For what is Barley generally used ?

Amongst us in making beer ; in Scotland it is a common ingredient in broths, for which reason its consumption is very considerable, barley broth being a dish as frequent there as that of soup in France.

*Ingredient*, a separate part of a body consisting of different materials.

What is Pearl Barley ?

Barley freed from the husk by a mill.

What are Oats ?

A valuable grain, serving as food for horses. Oats are also eaten by the inhabitants of many countries, after being ground into meal and made into oat cakes. Oat-meal also forms a wholesome drink for invalids, by steeping it in boiling water.

What are the uses of Rye ?

In some countries it is much used for bread, either alone or mixed with wheat ; with us principally as food for cattle, especially for sheep and lambs, when other food is scarce in winter. Rye yields a strong spirit when distilled.

*Distilled*, from distil, to let fall in drops.

Of what country is the Potatoe a native ?

Potatoes grew wild in Peru, a country of South America ; from whence they were transplanted to other parts of that continent, and afterwards to Europe. The honour of introducing this useful vegetable in England is divided between Sir Francis Drake, in 1580, and Sir Walter Raleigh, in 1586, some ascribing it to the former and others to the latter.

In what British island were they first cultivated ?

In Ireland, from whence they were introduced into England. They still form the principal food of the lower class of Irish.

What part of the plant is eaten ?

The root, which, when roasted or boiled, affords a wholesome and agreeable meal.



### What is Tea ?

The leaves of an evergreen shrub, a native of China and Japan, in which countries alone it was cultivated for use ; it has lately been introduced into South Carolina, a state of North America, with complete success.

*Evergreen*, a plant which retains its leaves fresh and green through all seasons.

### How is it prepared for use ?

By carefully gathering the leaves, one by one, while they are yet small, young, and juicy. They are then spread on large flat iron pans, and placed over small furnaces, when they are constantly shifted by the bare hand till they become too hot to be borne.

### What is next done ?

They take them off with a kind of shovel resembling a fan, and pour them on mats, from whence they are taken in small quantities, and rolled in the palm of the hand, in one direction, while others stand by and fan them that they may cool and retain the curl.

### How often is this operation repeated ?

Two or three times, the furnace each time being made less hot. The tea is then placed in the storehouses, or packed in chests, and sent to most of the countries in Europe.

### Describe the appearance of the Tea-tree.

The tea-tree when arrived at its full growth, which it does in about seven years, is about a man's height ; the green leaves are narrow, and longish at the point, and jagged all round ; the flower resembles that of the wild rose, but is smaller. The shrub loves to grow in valleys, at the foot of mountains, and on the banks of rivers, where it enjoys a southern exposure to the sun ; though it endures considerable variation of heat and cold, as it flourishes in the northern clime of Peking, where the winter is often severe, and also about Canton, where the heat is sometimes very great. The best tea, however, grows in a mild, temperate climate, the country about Nankin producing better tea than either Peking or Canton, between which two places it is situated.

What produces the difference between Green and Bohea, or Black ?

There are two varieties of the plant, cultivated in different districts, which produce the different kinds of tea.

What nation first introduced it into Europe ?

The Dutch, in 1610, from whence it was brought into England by Lord Arlington and Lord Ossory in 1666.

What is Coffee ?

The berry of the coffee-tree, a native of Arabia. The coffee-tree is an evergreen, and makes a beautiful appearance at all times of the year, but especially when in flower, and when the berries are red, which is usually during the winter. It is also cultivated in Persia, the East and West Indies, parts of South America, and most tropical countries.

Who was the original discoverer of coffee, for the drink of man ?

It is not exactly known : some ascribe it to the prior of a monastery ; who being informed by a goatherd, that his cattle sometimes browsing on the tree would wake and caper about all night, became curious to prove its virtue ; and accordingly tried it on his monks, to prevent their sleeping at matins. Others say that the Persians first introduced it, from whom it was obtained in the fifteenth century by the Turks. It seems, however, to have been first used at Aden, a city of Arabia, from whence it was taken to Egypt, and thence to Turkey.

*Matins*, morning prayers. *Century*, a hundred years. From the Latin *centum*, a hundred.

Who introduced it into France and England ?

Thevenot, the traveller, brought it into France, and a Greek servant named Pasqua (brought to England by Mr. Daniel Edwards, a Turkey merchant, in 1652, to make his coffee) first set up the profession of coffee-man, and introduced the drink among us.

How is it prepared ?

The berries are roasted on an earthen or metallic plate, till they are of a deep brown colour, and then ground to powder.

*Metallic*, consisting of metal.

What is Chocolate ?

A kind of cake or paste, made of the kernel of the cacao-nut. The nut is crushed in a kind of mill. The

best parts of the kernel are made into chocolate, which is sweetened with sugar and other ingredients; into the various preparations of cacao, or cocoa, falsely so called, all being the produce of the cacao-nuts; and the rinds of the seeds are sold, split and unprepared, under the name of "knibs."

What are its uses?

It is a favourite drink in Spain and Spanish America, and also much used in France, Great Britain, &c. The French use it in the form of sweetmeats, of which quantities are sold in this country. Chocolate and cocoa yield an esteemed and wholesome beverage when boiled in water or milk. The nut is of an oily nature, and this fat or oil, in the best kinds, is removed during their manufacture.

Describe the Cacao-nut tree.

It resembles the cherry-tree, and grows to the height of fifteen or sixteen feet. The cacao-nut tree bears leaves, flowers, and fruit, all the year through.

Where does it grow?

In the tropical regions of America, where it is largely cultivated; and at Caraccas, Carthage, Trinidad, and several other places between the tropics.

*Tropics*, the imaginary lines which bound the torrid zone, so called because they are the hottest regions of our globe. The word is from a Greek one, signifying to burn.

Of what form is the fruit?

It is something like a cucumber, about three inches round, and of a yellowish red colour. It contains from ten to forty seeds, each covered with a little rind, of a violet colour; when this is stripped off, the kernel, of which they make the chocolate, is visible.

### CHAPTER III.

CALICO, COTTON, CLOTH, WOOL, BAIZE, LINEN, FLAX, HEMP, DIAPER,  
HOLLAND, CANVAS, AND FLANNEL.

What is Calico?

A sort of cloth resembling linen, made of cotton.

From what place did it take its name?

From Calicut, a city on the coast of Malabar, where it was first made; much is now manufactured in England and many other countries.

What is Cotton?

A downy or woolly substance, enclosed in the pod, or seed-vessel, of the cotton plant. There are two sorts of cotton, one an herb, the other a small shrub: it is a native of the East Indies, and is likewise found growing naturally in the hot parts of Asia and Africa, and has even become an important object of cultivation in some parts of Europe.

Where is it most cultivated?

In the southern states of America, which exports a larger supply than any country of the world. In Egypt there are two sorts of cotton, which grow to the size of large trees.

How do they cultivate the herb cotton?

By sowing it on ploughed lands in the spring, and cutting it down like corn, in harvest time,—this kind being a yearly plant.

Where did cotton anciently grow, and for what was it used?

It first grew in Egypt, where it was used by the priests and sacrificers, for a very singular kind of garment worn by them alone.

In what manufacture is it now used?

It is woven into muslins, dimities, cloths, calicoes, &c.; and is also joined with silks and flax, in the composition of other stuffs, and in working with the needle.

How is the cotton separated from the seed?

With little machines, worked by the motion of a wheel, so that the cotton falls on one side, and the seed on the other. In America, however, they have two sorts of machines, called cotton gins, one working by rollers, which draw the cotton from the seeds, and the other by round saws, turning on a common axis between rows of wires, which pull the seeds from the cotton.

How is it made into calico, &c.

The cotton having been separated from the seed, is spun by a machine for the purpose. It is next woven, then dressed and prepared for wear.

What is Cloth?

The word, in its general sense, includes all kinds of stuffs woven in the loom, whether the threads be of wool, hemp, or flax.

To what is it more particularly applied?

To a web or tissue of woollen threads interwoven.

*Interwoven*, woven one into another.

What is Wool?

The covering or hair of sheep. To prepare it for the weaver, it is first shorn, washed, and dried, then carded or combed, by machinery for the purpose, into fibres or threads: formerly this was always performed by the hand, by means of an instrument, called a comb, with several rows of pointed teeth; and though not much used now, is still occasionally employed, except in large factories. This combing is repeated two or three times, till it is sufficiently smooth and even for spinning.

How was spinning or converting wool, cotton, silk, &c. into thread, anciently performed?

By the distaff and spindle: these we find mentioned in sacred history, and the same plan has been resorted to in all ages and countries yet discovered. The natives of India, and of some other parts of the world, still employ this simple invention.

What was the next improvement?

The invention of the hand-wheel. In 1767, a machine called the spinning-jenny was invented by a weaver named Hargraves; but the greatest improvement in the art of spinning was effected by Mr. (afterwards Sir Richard) Arkwright in 1768: these two inventions were combined, and again improved upon in 1776; so that by the new plan, a much larger quantity of material can be converted into thread in a considerably shorter space of time than was consumed by the ancient mode. The sheep, whose wool forms the material for nearly all woollen clothing, came originally from Africa.

Does weaving differ according to the material used?

The principle of weaving is the same in every kind of fabric, and consists in forming any kind of thread into a flat web, or cloth, by interlacing one thread with another; the various appearances of the manufacture arise as much

from the modes in which the threads are interwoven as from the difference of material.

Is not the employment of wool in the manufacture of Clothing of great antiquity?

In the earliest records we possess of the arts of mankind, wool is mentioned, as forming a chief article in the manufacture of clothing; it is spoken of in the Bible, as a common material for cloth as early as the time of Moses. The ancient Greeks and Romans are well known to have possessed this art. At the beginning of the thirteenth century, the manufacture was established in many parts of Europe, particularly in Spain, from which country it extended itself to France and Italy. There is no doubt that it was introduced into England by its conquerors the Romans, a manufactory being established, sufficiently large to supply the Roman army at Winchester.

*Manufactory*, a place where things are made or manufactured; derived from the Latin *manus*, a hand, and the verb *facio*, to do or make.

What circumstance contributed to the progress of this manufacture among us?

In 1330, the English being desirous of improving their woollen manufacture, invited over the Flemings, by the offer of various privileges, to establish manufactories in this country. The skill of these people soon effected a great improvement in the English fabrics, so that there no longer remained any occasion for the exportation of English wool into Flanders, to be manufactured into fine cloth; and a law was passed by government to forbid it.

What country affords the best wool?

The wool of Germany is most esteemed at the present day; that of Spain was formerly the most valuable, but the Spanish breed of sheep having been introduced into Germany, succeeded better there than in Spain, and increased so rapidly, that the Spanish wool trade has greatly diminished.

Who introduced the Merino sheep into England?

King George the Third; and though they did not succeed to any great extent, yet they have greatly improved the English breed. Those on the Cheviot hills are said to produce the best. But Australia promises, at no distant day, to be one of the principal wool-growing countries in the

world, for the same breed of sheep sent out to that country and Van Diemen's Land have succeeded remarkably well.

Where are the Cheviot hills situated ?

On the borders of Scotland, forming a kind of boundary between that country and its sister England.

What part of the world is meant by Australia ?

New Holland, now called Australia, or New South Wales; it is the principal of the group of large islands, now the Oriental Archipelago, called Australasia. New South Wales, colonised by Britain, is the largest island in the world; its capital is Sydney. Van Diemen's Land is another of the same group, separated from New South Wales by a channel called Bass's Strait, and is also colonised by Great Britain.

What is meant by the Archipelago ?

A part of a sea studded with numerous islands: but the term is more particularly applied to that lying between Europe and Asia, which contains the Greek Islands. The word is a corruption from the Greek, signifying the Egean Sea.

Is the wool of the sheep all of one quality ?

No; it varies according to the species of sheep, the soil on which they are fed, and the part of the animal from which it is taken; the chief distinction is between the long and the short wool; the long wool is employed in the manufacture of carpets, crapes, blankets, &c.; and the finer and shorter sorts, for hosiery, broadcloths, &c.

Where were carpets originally made ?

Carpets are of oriental origin, and are made of different sorts of stuffs; they are woven in a variety of ways. Persian and Turkey carpets are most esteemed; they are woven in a piece, in looms of a very simple construction. Till late years the manufacture of these carpets was confined to Persia and Turkey; but they are now successfully imitated at Axminster, in the south of England, Kilmarnock, in Scotland, &c. Brussels, Wilton, and Kidderminster carpets derive their names from the places where they were invented; besides other kinds which differ slightly in the manner in which they are woven, and the quality of the material.

Is not the art of weaving very ancient ?

It appears to have been known from a period as early as the time of Abraham and Jacob ; its inventor is not known, but it is possible that men took a lesson from the ingenious spider, which weaves its web after the same manner. The ancient Egyptians appear to have brought it to great perfection, and were even acquainted with the art of interweaving colours after the manner of the Scottish plaid.

What is Baize ?

A coarse open stuff, made of wool ; it is used for many purposes, such as curtains, cloths, &c. ; and is chiefly made in England, Flanders, France, &c.

What is Linen ?

There are various kinds of linen, made from cotton, flax, and hemp ; but the term is chiefly applied to that woven with the two last mentioned, called Irish, from its being almost entirely made in Ireland. Linen means cloth of flax ; hence its derivation from the Latin word *linum*, flax.

What is Flax ?

An annual plant, the fibres of which are beaten into threads, spun, and afterwards woven into linen, for which purpose it is cultivated in Great Britain, many countries of Europe, and in America. In Russia, flax and hemp are cultivated to a larger extent than in any other country, and considered the best that are grown. The English flax is said to be superior, but there is not much of it raised, because the land in our country can be turned to better account in the culture of other articles, as wheat, &c. Hemp is a plant of a similar nature, equally used with flax, in the manufacture of linens.

How long has the use of hemp and flax been known ?

These plants are said to be natives of Persia, and introduced from some parts of the East into Europe, over which it is now widely distributed ; it existed both in a wild and cultivated state, in some parts of Russia, as early as five centuries before Christ. These products form a considerable article of exportation, besides the quantity used in Russia itself.

Into what is it chiefly wrought ?

Into linens, diapers, canvas, and other manufactures ; and even the seeds are exported, both in their natural



state and as oil. In various parts of Russia, hemp-seed, oil and flax-seed (or linseed) oil are prepared in very large quantities.

What is Diaper?

A sort of linen cloth woven in flowers and other figures; it is said to have received its name from d'Iper, now Ypres, a town of the Netherlands, situated on a river of the same name, where it was first made.

What is Holland?

A fine, close, even, linen cloth, used for sheets, &c. It obtained its name from being principally made in Holland, and other parts of the United Provinces.

What is Canvas?

A hempen cloth, so loosely woven as to leave interstices between the threads, in little squares. It is used for working in patterns upon it with wools, &c.; by painters for a groundwork on which they draw their pictures; for packing, and many other domestic purposes. There are several sorts, all varying in the coarseness or fineness of their texture. It is manufactured in various parts of Europe, and much of it is imported to us from Holland.

What is Damask?

A sort of silken stuff, having some parts raised on its surface to represent flowers or figures. It took its name from Damascus, in Syria, whence it was first brought.

Is there not another sort of damask?

Yes, made from linen; and so called because its large flowers resemble those of damask roses. It was first made in Flanders, and is used for table linen, &c.

What is Flannel?

A slight, loose, woollen stuff, used for warm clothing; it was originally made in Wales, where it still continues to be manufactured in great perfection.

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#### CHAPTER IV.

COCOA, TODDY, CHERRIES, BARK, CORK, COCHINEAL, CLOVES,  
CINNAMON, AND CASSIA.

Of what form is the tree which bears those large nuts, called Cocoa nuts?

It is tall and straight, without branches, and generally

about thirty or forty feet high ; at the top are twelve leaves, ten feet long, and half a foot broad ; above the leaves grows a large excrescence in the form of a cabbage, excellent to eat, but taking it off kills the tree. The cocoa is a species of Palm.

Is not the Indian liquor, called Toddy, produced from the cocoa-tree ?

Yes ; between the leaves and the top arise several shoots about the thickness of a man's arm, which when cut, distil a white, sweet, and agreeable liquor ; while this liquor exudes, the tree yields no fruit, but when the shoots are allowed to grow, it puts out a large cluster or branch, on which the cocoa nuts hang, to the number of ten or twelve.

*Distil*, to let fall in drops. *Exude*, to force or throw out.

How often does this tree produce nuts ?

Three times a year, the nuts being about the size of a man's head, and of an oval form.

Of what countries is it a native ?

Of Asia, the Indies, Africa, Arabia, the Islands of the Southern Pacific, and the hottest parts of America.

What are the uses of this tree ?

The leaves of the tree are made into baskets ; they are also used for thatching houses : the fibrous bark of the nut, and of the trunk of the tree, is made into cordage, sails, and cloth ; the shell, into drinking-bowls and cups ; the kernel affords a wholesome food, and the milk contained in the shell, a cooling liquor.

From what country was the Cherry-tree first brought ?

From Cerasus, a city of Pontus, in Asia, on the southern borders of the Black Sea ; from which place this tree was brought to Rome, in the year of that city 680, by Lucullus ; it was conveyed, a hundred and twenty years after, into Great Britain, in A.D. 55.

What is the meaning of A.D. ?

A short way of writing Anno Domini, Latin words for, *in the year of our Lord*.

Who was Lucullus ?

A renowned Roman General.

Is the wood of the cherry-tree useful ?

The French use it in cabinet-making (on account of its agreeable odour), for boxes, and other articles.

### What is Bark ?

The exterior part of trees, which serves them as a skin or covering.

*Exterior, the outside.*

Does it not undergo some change during the year ?

Each year the bark of a tree divides, and distributes itself two contrary ways, the outer part gives towards the skin, till it becomes skin itself, and at length falls off; the inner part is added to the wood. The bark is to the body of a tree, what the skin of our body is to the flesh.

Of what use is bark ?

Bark is useful for many things: of the bark of willows and linden trees, ropes are sometimes made. The Siamese make their cordage of the cocoa-tree bark, as do most of the Asiatic and African nations; in the East Indies they make the bark of a certain tree into a kind of cloth or stuff; some are used in medicines, as the Peruvian or Jesuit's bark; others in dyeing, as that of the alder; others in spicery, cinnamon, &c.; the bark of oak, in tanning; that of a kind of birch is used by the Indians for making canoes capable of holding twenty-four people.

What is a Canoe ?

A little boat used by the savages in both Indies, as well as by the negroes of Guinea; they are made chiefly of the trunks of trees dug hollow, and sometimes of pieces of bark fastened together.

How do they guide them ?

With paddles, or oars; they seldom carry sails, and the loading is laid in the bottom.

Are not the savages very dexterous in the management of them ?

Yes, extremely so; they strike the paddles with such regularity, that the canoes seem to fly along the surface of the water; while at the same time they balance the vessel with their bodies, to prevent its overturning, which, on account of its lightness, would continually happen.

*Dexterous, expert, nimble.*

Do they leave their canoes in the water on their return from a voyage ?

No; they draw them ashore, hang them up by the two ends, and leave them to dry; they are generally so

light, that two men can easily carry them on their shoulders.

Were not books once made of bark?

Yes; the ancients wrote their books on the barks of many trees, as on those of the ash and the lime-tree, &c.

Which part did they use?

Not the exterior or outer bark, but the inner and finer, which is of so durable a texture, that there are manuscripts written on it which are still extant, though more than a thousand years old.

Is it not also used in Manure?

Yes; especially that of the oak; but the best part of it is used in tanning.

What is Cork?

The thick, spongy, external bark of the cork-tree, a species of oak. There are two varieties of this tree, the broad leaved and the narrow: it is an evergreen, and grows to the height of thirty feet. The cork-tree attains to a very great age.

Where is the tree found?

In Spain, Italy, France, and many other countries. The true cork is the produce of the broad leaved tree.

What are its uses?

Its chief employ is to put in shoes, and to stop bottles, &c. The Spaniards burn it to make that kind of light black, we call Spanish black, so much used by painters. The greatest quantities are brought over from Catalonia, in Spain. The uses of Cork were well known to the ancients, and it was employed for nearly the same purposes to which it is now applied by us.

To what particular use did the Egyptians put it?

They made coffins of it, lined with a resinous composition, which preserved the bodies of the dead uncorrupted.

What is Cochineal?

A drug used by the dyers, for dyeing crimsons and scarlets; and for making carmine, a brilliant red used in painting, and several of the arts.

Is it a plant?

No; it is an insect. The form of the cochineal is oval; it is about the size of a small pea, and has six legs, armed

with claws, two eyes, and a trunk, by which it sucks its nourishment.

What is its habitation?

It breeds in a fruit resembling a pear; the plant which bears it is about five or six feet high; at the top of the fruit grows a red flower, which, when full blown, falls upon it; the fruit then appears full of little red insects, having very small wings. These are the cochineals.

How are they caught?

By spreading a cloth under the plant, and shaking it with poles till the insects quit it and fly about, which they cannot do many minutes, but soon tumble down dead into the cloth, where they are left till quite dry.

Does the insect change its colour when it is dead?

When the insect flies it is red; when it is fallen, black; and when first dried, it is greyish; it afterwards changes to a purplish grey, powdered over with a kind of white dust.

From what countries is the cochineal brought?

From the West Indies, Jamaica, Mexico, and other parts of America.

What are Cloves?

The dried flower buds of the clove-tree, anciently a native of the Moluccas, but afterwards transplanted by the Dutch (who traded in them) to other islands particularly that of Ternate. It is now found in most of the East India islands.

Describe the Clove-tree.

It is a large handsome tree of the myrtle kind; its leaves resemble those of the laurel. Though the clove-tree is cultivated to a great extent, yet, so easily does the fruit on falling take root, that it thus multiplies itself, in many instances, without the trouble of culture. The clove when it first begins to appear is white, then green, and at last hard and red; when dried it turns yellow, and then dark brown.

What are its qualities?

The clove is the hottest and most acrid of aromatic substances; one of our most wholesome spices, and of great use in medicine; it also yields an abundance of oil, which is much used by perfumers, and in medicine.

*Acrid*, of a hot biting taste.

### What is Cinnamon?

An agreeable, aromatic spice, the bark of a tree of the laurel kind. The cinnamon-tree grows in the southern parts of India, but most abundantly in the island of Ceylon, where it is extensively cultivated; its flowers are white, resembling those of the lilac in form, and are very fragrant; they are borne in large clusters. The tree sends up numerous shoots the third or fourth year after it has been planted; these shoots are planted out when nearly an inch in thickness.

*Aromatic*, having a brisk, fragrant smell, and a warm, spicy taste.

### How do they procure the bark?

By stripping it off from these shoots after they have been cut down. The trees planted for purpose of obtaining cinnamon, throw out a great number of branches, apparently from the same root, and are not allowed to rise higher than ten feet; but in its native uncultivated state, the cinnamon-tree usually rises to the height of twenty or thirty feet.

### How is the cinnamon-tree cultivated?

By seed sown during the rains, from shoots cut from large trees, and by transplanting old stumps. The cinnamon-tree, in its wild state, is said to be propagated by means of a kind of pigeon, that feeds on its fruit; in carrying which to the nest, the seeds fall out, and dropping in various places, take root, spring up, and become trees.

*Propagated*, increased, continued.

### What else is obtained from this tree?

The bark, besides being used as a spice, yields an oil, highly esteemed, both as a medicine and as a perfume; the fruit by boiling also produces an oil, used by the natives for burning in lamps; as soon as it hardens, it becomes a solid substance like wax, and is formed into candles. Camphor is extracted from the root. Cassia is cinnamon of an inferior kind.

## CHAPTER V.

BOMBAZINE, CRAPE, CAMLET, CAMBRIC, LACE, SILK, VELVET, AND MOHAIR.

What is Bombazine ?

A stuff composed of silk and wool woven together in a loom. It was first made at Milan, and from thence sent into other countries ; great quantities are now made in England and other parts of Europe.

Where is Milan situated ?

In Austrian Italy, of which it is the capital city.

For what is Bombazine used ?

For dresses. Black bombazine is worn entirely for mourning. The original bombazine has, however, become much less used than formerly, on account of the numerous newly invented fabrics of finer or coarser qualities, composed of the same materials mixed in various degrees, as *Mousselines de laine*, *Challis*, &c.

What is Crape ?

A light transparent stuff, something like gauze, made of raw silk very loosely woven, or of wool ; by raw silk, is meant, silk in the state in which it is taken from the silkworm.

Where was crape first made ?

At Bologna, a city of Roman Italy.

What city of France was long celebrated for its manufacture ?

Lyons, the second city of France, where there are large silk manufactures. Great quantities are also made in England. The city of Norwich was long distinguished for the beauty of its crapes ; the manufacture being at first almost exclusively confined to Norwich.

What is Camlet ?

A stuff made sometimes of wool, and sometimes of silk and hair, especially that of goats. The oriental camlet is made of the pure hair of a sort of goat, a native of Angora, a city of Natolia, in Turkey. The European camlets are made with a mixture of woollen thread and hair. This stuff is now little made in this country ; there are, however, many combinations of the same materials

in different degrees and mixtures, which are sold under the names of Alpacas, &c.

What countries are most noted for them ?

England, France, Holland, and Flanders ; the city of Brussels, in Belgium, exceeded them all in the beauty and quality of its camlets ; those of England are the next.

What is Cambric ?

A species of linen made of flax ; it is very fine and white.

From whence did it take its name ?

From Cambray, a large and celebrated city of French Flanders, where it was first made ; it is now made at other places in France, and also in England, Scotland, and Ireland.

What is Lace ?

A work composed of many threads of fine linen or silk, interwoven one with another according to some particular pattern. There are many towns in England, particularly in Buckinghamshire, in which this manufacture is carried on ; vast quantities of the finest laces were formerly imported from Flanders.

From what is Silk produced ?

From the silkworm, an insect not more remarkable for the precious matter it furnishes, than for the many forms it assumes before and after it envelopes itself in the beautiful ball, the silken threads of which form the elegant texture which is so much worn.

*Texture*, a web or substance woven.

What are the habits of this insect, and on what does it feed ?

After bursting from the egg (which is its first state), it becomes a large worm or caterpillar of a yellowish white colour ; this caterpillar feeds on the leaves of the mulberry-tree, till, arriving at maturity, it winds itself up in a silken bag or case about the size and shape of a pigeon's egg, and becomes a chrysalis ; in which state it lies without signs of life ; in about ten days it eats its way out of its case, a perfect butterfly, which lays a number of eggs and then dies. In the warmth of the summer weather, these eggs are hatched, and become worms, as their parents did at first.

*Maturity*, ripeness, perfection.



How much silk is each ball said to contain?

Each ball consists of a very fine, soft, bright, delicate thread, which being wound, extends in length six English miles.

What is meant by Chrysalis?

The third state into which the insect passes before it becomes a butterfly. The maggot or worm having ceased to eat, fixes itself in some place till its skin separates, and discovers a horny, oblong body, which is the chrysalis.

Where was silk first made?

The culture and manufacture of silk was originally confined to China; and the Chinese appear to have known and practised the art, 2700 years before Christ. The Greeks, under Alexander the Great, brought home, among other Eastern luxuries, wrought silks from Persia, in 323. It was not long unknown to the Romans, although it was so rare, that it was even sold weight for weight with gold. The Emperor Aurelian, who died in 275, refused the Empress, his wife, a suit of silk which she solicited with much earnestness, merely on account of its dearness. Heliogabalus, the Emperor, who died half a century before Aurelian, was the first who wore a *holosericum* or garment all of silk.

Who introduced the Silkworm itself into Europe?

Two monks, engaged as missionaries in China, obtained a quantity of silkworms' eggs, which they concealed in a hollow cane, and conveyed them in safety to Constantinople in 552; the eggs were hatched in the proper season by the warmth of manure, and the worms fed with the leaves of the wild mulberry-tree. These worms in due time spun their silk, and propagated under the care of the monks, who also instructed the Romans in the whole process of manufacturing their production.

What followed?

From the insects thus produced, proceeded all the silkworms which have since been reared in Europe and the western parts of Asia. The mulberry-tree was then eagerly planted, and on this, their natural food, they were successfully reared in Greece; and the manufacture was established at Thebes, Athens, and Corinth, in particular.

The Venetians soon after this time commencing a trade with the Greeks, supplied all the western parts of Europe with silks for many centuries.

Where were the cities of Thebes and Athens situated ?

Thebes was an ancient city of Bœotia, in Greece, founded by Cadmus, a Phœnician, though of Egyptian parentage. He, sailing from the coast of Phœnicia, arrived in Bœotia, and built the city, calling it Thebes, from the city of that name in Egypt. To this prince is ascribed the invention of sixteen letters of the Greek alphabet. Athens was the capital of Attica, founded by Cecrops, an Egyptian.

Of what was it the centre ?

Of learning and the arts; it has produced some of the most celebrated warriors, statesmen, orators, poets, and sculptors in the world. Since the emancipation of Greece from the cruel bondage of its conquerors the Turks, who had oppressed it for three centuries, Athens has been chosen as its capital, and is still a considerable town, adorned with splendid ruins of the beautiful buildings it once possessed. Thebes, and Corinth, another celebrated city, are now only villages.

*Warrior*, a soldier. *Statesmen*, men versed in the arts of government. *Orator*, a public speaker. *Poet*, one who composes poetry. *Sculptor*, one who cuts figures in stone, marble, or ivory.

Who were the Venetians ?

Inhabitants of Venice, the capital city of a province in Italy, of the same name.

Did this manufacture continue to be confined to the Greeks and Venetians ?

By no means. The rest of Italy, and Spain, by degrees learnt the art from some manufactories in Sicily : and about the reign of Francis the First, the French became masters of it. It, however, long remained a rarity ; their king, Henry the Second, is supposed to have worn the first pair of knit silk stockings. The fourth Henry encouraged the planting of mulberry-trees ; his successors also did the same, and the produce of silk in France is now very considerable.

When did the use of silk come into England ?

There was a company of silk women in England as

early as the year 1455; but they probably were merely employed in needlework of silk and thread, for Italy supplied England with the broad manufacture during the chief part of the fifteenth century.

What king was anxious to secure the advantages afforded by this new manufacture?

King James the First was very desirous for its introduction into England, particularly in 1608, when it was recommended several times in very earnest terms, to plant mulberry-trees for the rearing of silkworms; but unhappily without effect. However, towards the latter end of his reign, the broad silk manufacture was introduced, and with great success. The revocation of the Edict of Nantes contributed greatly to its promotion, by the number of French workmen who took refuge in England; to them we are indebted for the art of manufacturing many elegant kinds of silks, satins, velvets, &c. which had formerly been imported from abroad up to the year 1718.

*Revocation*, act of recalling, repeal. *Imported*, brought into.

What was the Edict of Nantes?

The repealing of a law made in favour of the Protestants, which drove many of their most skilful workmen to take refuge in this island. They were kindly received, and settled in Spitalfields, and many other parts of England as well as Ireland, where they carried on a flourishing and ingenious manufacture.

Were the attempts to rear silkworms in England successful?

No; after many trials, all of which failed, attention was directed to the establishments for procuring both raw and wrought silks, in the settlements in India belonging to Britain; this was attended with complete success, the climate being extremely favourable, and the price of labour cheap. Raw silk is imported in quantities from India, China, Italy, &c., to Great Britain every year.

How is the silk taken from the worm?

The people who are employed in the care of these insects collect the golden balls from off the mulberry-trees (to the leaves of which the insects glue their silk), and put them into warm water that the ends may unfasten

and wind more easily ; having taken off the coarse woolly part which covers the balls, they take the ends of twelve or fourteen at a time, and wind them off into skeins. In order to prepare this beautiful material for the hand of the weaver to be wrought into silks, stuffs, brocades, satins, velvets, ribands, &c., it is spun, reeled, milled, bleached, and dyed.

*Milled*, worked in a kind of mill. *Bleached*, whitened.

What is Velvet ?

A rich kind of stuff, all silk, covered on the outside with a close, short, fine, soft shag ; the wrong side being very strong and close. The best and the greatest number of velvets, were made in France and Italy ; others in Holland ; they are now brought to great perfection in our own country. An inferior kind is made by mixing cotton with the silk. Velvet has been known in Europe for some centuries, but its manufacture was long confined to some of the chief cities of Italy. From that country the French learned the art, and greatly improved it.

From whence is the word velvet derived ?

From the Italian word *velluto*, signifying velvet, which comes from *vello*, a thing covered with hair or fleece ?

What is Mohair ?

The hair of a kind of goat, common about Angora, in Turkey. It is used in the manufacture of various kinds of stuffs, shawls, &c.

Is there not another animal much celebrated for the material it furnishes in the making of shawls ?

Yes ; the Shawl-goat of Cashmere, in the kingdom of Thibet or Tibet. Cashmere is the name both of a country and of the capital city belonging to it. It is situated in the north-west extremity of India, and has long been celebrated for the beautiful and valuable shawls bearing its name which were manufactured there. The shawl-goats are beautiful creatures, with long, fine, wavy hair, reaching nearly to the ground, so as almost to conceal their legs. The material of which the shawls are made is a fine, silky down, which grows under the long hair, next to the skin.

## CHAPTER VI.

CURRENTS, RAISINS, FIGS, RICE, SUGAR, SUGAR CANDY, &c., SAGO, MILLET, GINGER, NUTMEG, MACE, PIMENTO OR ALLSPICE, PEPPER, AND CAYENNE PEPPER.

What are Currants ?

A kind of small raisins or dried grapes.

Whence are they brought ?

From several islands of the Archipelago, particularly Zante and Cephalonia ; and from the Isthmus of Corinth, in Greece.

Do they grow on bushes like our currants ?

No, on vines like other grapes, except that the leaves are somewhat thicker, and the grapes much smaller : they have no pips, and are all of a deep red, or rather black.

When are they gathered, and how are they dried ?

They gather them in August, and lay them on the ground in heaps till dry ; they are then cleaned and put into magazines, from which they are taken and packed in barrels for exportation.

What do you mean by Exportation ?

The act of conveying goods for sale from one country to another.

What are Raisins ?

Grapes prepared by drying them in the sun, or in the air ; of these there are various kinds, as raisins of Damascus, so called from the capital city of Syria, near which they are cultivated. They are very large, flat, and wrinkled on the surface ; soft and juicy inside, and nearly an inch long. Raisins of the sun, or jar raisins, so called from being imported in jars, are all dried by the heat of the sun ; they are of a reddish blue colour, and are the produce of Spain, from whence the finest and best raisins are brought. There are several other sorts, named either from the place where they grow, or the kind of grape of which they are made, as those of Malaga, Valencia, &c.

In what manner do they dry them ?

They tie two or three bunches firmly together, while yet on the vine, and dip them into a ley made of hot wood ashes, mixed with a little olive oil. This makes them shrink and wrinkle : after this they are cut from the branches

which supported them, but left on the vine for three or four days, separated on sticks, in an upright position, to dry at leisure. Different modes, however, are adopted, according to the quality of the grape. The commonest kinds are dried in hot ovens, but the most simple and the best way is that in which the grapes are cut when fully ripe, and dried by the heat of the sun, on a floor of hard earth or stone.

*Ley*, a liquor made from wood ashes; of great use in medicine, bleaching, sugar works, &c.

What are Figs?

A soft, luscious fruit, the produce of the fig-tree. The best figs are brought into England from Turkey, but they are also imported from Italy, Spain, and the southern part of France. The islands of the Archipelago yield an inferior sort in great abundance. In England they are sometimes planted in a warm situation in gardens, but, being difficult to ripen, they do not arrive at perfection. The figs sent from abroad are dried (as we have them from the shops) by the heat of the sun, or in furnaces for the purpose.

*Luscious, sweet, cloying.*

What is Rice?

A useful and nutritious grain cultivated in all parts of the East, where it forms the principal food of the inhabitants; great quantities of rice are brought over annually into Europe. Rice is cultivated in most hot countries; its culture is probably more extensive than that of wheat, and affords more food and as much employment as wheat does in Europe.

*Nutritious, wholesome, good for food.*

Does it not require a great deal of moisture?

Yes; it is usually planted in moist soils, and near rivers, where the ground can be overflowed after it is come up. The Chinese water their rice-fields by means of movable mills, placed, as occasion requires, upon any part of the banks of a river; the water is raised in buckets to a proper height, and afterwards conveyed in channels to the destined places.

What is Sugar?

A sweet agreeable juice, expressed from the sugar-cane,

a native of the East and West Indies, South America and the South Sea Islands ; it is much cultivated in all tropical countries. The earliest authentic accounts of sugar, are about the time of the Crusades,\* when it appears to have been purchased from the Saracens, and imported into Europe.

*Tropical*, belonging to the tropics. *Authentic*, true, certain, capable of being believed. *Crusades*, holy wars. *Saracens*, Turks or Arabs.

How is it prepared ?

The canes are crushed between large rollers in a mill, and the juice collected into a large vessel placed to receive it ; it is then boiled, and placed in pans to cool, when it becomes imperfectly crystallised, in which state we use it. This is called raw or soft sugar ; loaf sugar, or the hard white sugar, is the raw brown sugar prepared by refining it with bullock's blood and lime-water, till all foreign matter is removed.

Is the sugar-cane the only vegetable that produces sugar ?

All vegetables possess more or less sugar in different degrees, but the plant in which it most abounds is the sugar-cane. In the United States of America, a large quantity of the sugar consumed is prepared from the sap of the sugar maple-tree. The trees are tapped at the proper season by a cut being made in the bark ; and the juice runs into a vessel placed to receive it : it is then prepared in the same manner as the juice of the sugar-cane.

What is Sugar Candy ?

Sugar purified and crystallised.

What is Barley Sugar ?

Sugar boiled till it is brittle, and cast on a stone anointed with oil of sweet almonds, and then formed into twisted sticks.

What is Sago ?

A substance prepared from the pith of the sago palm, which grows naturally in various parts of Africa and the Indies. The pith, which is even eatable in its natural state, is taken from the trunk of the tree, and thrown into a vessel placed over a horse-hair sieve ; water is then

\* See Chapter xvii., article Navigation.

thrown over the mass, and the finer parts of the pith pass through the sieve ; the liquor thus obtained is left to settle. The clear liquor is then drawn off, and what remains is formed into grains by being passed through metal dishes, with numerous small holes ; it is next dried by the action of heat, and in this state it is imported. The sago palm also produces sugar.

What is Millet, and in what country does it grow ?

Millet is an esculent grain, one sort of which grows naturally in India ; it is also cultivated in many parts of Europe, but most extensively in Egypt, Syria, and China ; another kind is a native of Vera Cruz. Millet was originally brought from the Eastern countries ; from whence we are furnished with it, it being rarely cultivated in England, except as a curiosity.

*Esculent*, good for food.

Where is Vera Cruz ?

It is a seaport town of New Spain, North America.

For what is Millet used ?

It is in great request among the Germans for puddings ; for which it is sometimes used amongst us. The Italians make loaves and cakes of it.

What is Ginger ?

The root of a plant cultivated in the East and West Indies ; it is also much cultivated in America for sale, the dried root being sent over to Europe in great quantities. It is a native of south-eastern Asia and the adjoining islands.

What is its nature and use ?

It is a warm aromatic, much used in medicine and cookery. The Indians eat the root when green as a salad, chopping it small with other herbs ; they also make a candy of it with sugar. The ginger sold in the shops here is dried ; which is done by placing the roots in the heat of the sun or in ovens, after being dug out of the ground. Quantities not only of the dried root, but also of the candied, are imported into Europe.

What are Nutmegs ?

A delicate aromatic fruit or spice, brought from the East Indies. The nutmeg-tree greatly resembles our pear-tree ; and produces a kind of nut, which bears the same name.



What is the appearance of the Nutmeg?

Its form is round, and its smell agreeable. The nutmeg is enclosed in four different covers: the first, a thick fleshy coat (something like our walnut), which opens of itself when ripe; under this lies a thin reddish network, of an agreeable smell and aromatic taste, called mace; this wraps up the shell, which opens as the fruit grows. The shell is the third cover, which is hard, thin, and blackish; under this is a greenish film, of no use; and in the last you find the nutmeg, which is the kernel of the fruit.

What are its uses?

The nutmeg is much used in our food, and is of excellent virtue as a medicine. It also yields an oil of great fragrantcy.

Is the Mace used as a spice?

Yes, it is separated from the shell of the nutmeg, and dried in the sun. It is brought over in flakes of a yellow colour, smooth and netlike, as you see it in the shops. Its taste is warm, bitterish, and rather pungent; its smell fragrant and aromatic. It is used both in food and medicine, as the nutmeg, and also yields an oil.

*Pungent*, of a hot, biting taste.

What is Pimento or Allspice?

The dried unripe berry or fruit of a tree growing in great abundance in Jamaica, particularly on the northern side of that island, on hilly spots near the coast; it is also a native of both Indies. The pimento-tree is a West Indian species of myrtle; it grows to the height of twenty or thirty feet; the leaves are all of a deep, shining green, and the blossom consists of numerous branches of small, white, aromatic flowers, which render its appearance very striking, and there is scarcely, in the vegetable world, any tree more beautiful than a young pimento about the month of July, when it is in full bloom.

When is the time to gather the spice?

About the month of September, not long after the blossoms are fallen; the berries are gathered by hand, while two or three persons are employed below in picking them up, and carefully separating the fruit from the small twigs, leaves, and ripe berries.

What is next done?

They are exposed to the sun at its rising and setting for some days ; and spread thinly out the first and second day, very often, that they may be better exposed to the sun ; but when they begin to dry, they are frequently winnowed, and laid on cloths to preserve them better from rain and dew ; by this management they become wrinkled, and change from green to a deep reddish brown colour. Great quantities are imported into Europe.

What are its uses ?

It forms an agreeable addition to flavour food ; it also yields an elegant essential oil, and is accounted the best and mildest of common spices.

*Essential*, pure ; extracted so as to contain all the virtues of the spice in a very small compass.

Why is it called Allspice ?

Because it is a real aromatic, and may supply the want of cloves, nutmeg, and cinnamon, all of which it is thought to resemble ; from which the English call it *All-Spice*. The French call it *round clove*, from its round shape, and the taste being something like that spice.

What is Pepper ?

The product of a creeping shrub, growing in several parts of the East Indies, Asia, and America.

In what manner does pepper grow, and what part of the shrub is used ?

Pepper is the fruit of this shrub, and grows in bunches or clusters, at first green ; as it ripens it becomes reddish, until, having been exposed for some time to the heat of the sun (or probably gathered before perfectly ripe), it becomes black, as in the condition we have it. There are two sorts, the black and the white.

How is the White produced ?

The white pepper is merely the black deprived of its outside skin. For this purpose the finest red berries are selected, and put in baskets to steep, either in running water, or in pits dug for the purpose, near the banks of rivers. Sometimes they are only buried in the ground. In any one of these situations, they swell and burst their skins, from which they are carefully separated by drying in the sun, rubbing between the hands, or fanning.

What is Cayenne Pepper ?

The dried fruit of a plant called bird pepper, a native of both Indies. It is more pungent than the other sorts. The proper title is capsicum, of which another species yields the dried scarlet fruit sold under the name of chillies.

## CHAPTER VII.

GLASS, MIRRORS, EARTHENWARE, PORCELAIN, NEEDLES, PINS, PAPER, PRINTING, PARCHMENT, AND VELLUM.

What is Glass?

A transparent, solid, brittle, factitious body, produced by the melting of a kind of salt with sand or stone, by the action of fire.

*Factitious*, made by art; not found in a state of nature.

What salt is used in the manufacture of glass?

Chiefly that which is taken from the ashes of the plant kali, sometimes called glass-weed. It is generally brought from the shores of the Mediterranean, Alexandria, and Tripoli. Soda\* or potash is also used for the same purpose. The use of kali is to cause the sand or stone to melt when in the fire. It received the name of Kali or Alkali from the Arabians—which signifies the “dregs of bitterness.”

What else does Alkali denote?

The word was first applied to a salt obtained from the ashes of burnt kali, and is now a general term for an order of salts of great use and importance in chemistry.†

What is Potash?

A salt obtained from the burnt ashes of certain vegetables, used in the making of glass, soap, &c., as the ashes of the herb kali. Potash is also a term commonly applied to the saline matter obtained from all kinds of wood ashes, which are mixed together for the making of green glass.

What does it more generally denote?

An alkaline salt, called *vegetable alkali*, which is obtained from most vegetables by burning. Potash, or potass, is likewise procured from *some* minerals, though mostly from the ashes of burnt vegetables. Potass was known to the

\* See Chapter xiii., article Soap.      † Ditto, article Soda.

ancient Gauls and Germans; and soda was familiar to the Greeks and Hebrews.

*Gauls*, the people of ancient Gaul, now named France.

How is the salt obtained from the burnt ashes?

By causing water to pass through them; the water then imbibes the salt, which is obtained from it by evaporation. When purified by burning, it is called pearlash. In the vast forests of Russia and America immense quantities are manufactured. The term potash arose from the water in which the ashes were washed being collected in iron pots.

How was the art of Glass-making discovered?

The period of its invention is quite unknown. Pliny relates that some merchants, driven by a storm to the coast of Phœnicia, near the river Belus, made a large fire on the sand to dress some food, using as fuel some of the plant kali, which grew there in great abundance; an imperfect glass was thus formed by the melting of the sand and ashes together. This production was picked up by a Syrian merchant, who, attracted by its great beauty, examined the cause of its origin, and, after many attempts, succeeded in its manufacture.

Who was Pliny?

A celebrated Roman naturalist and historian.

At what place was glass first said to be made?

Some authors mention Sidon in Syria, which became famous for glass and glass-houses; but others maintain that the first glass-houses noticed in history were built at Tyre; which, they add, was the only place where glass was made for many ages. It is certain that the art was known to the Egyptians as early as the time of Abraham, and that they coloured it in a most beautiful manner, and also made of it artificial gems.

What is Phœnicia?

A subdivision of Syria in Asia.

What is an author?

A person who writes a book.

What is signified by a glass-house?

A building erected for the making and working of glass.

What country had glass windows first?

Italy, then France, from whence they came into England, and began to be common about the year 1180.

In what year was the making of glass bottles begun in England?

In 1557, in London. The first glass plates for mirrors and coach windows were made at Lambeth, in 1673.

What is a Mirror?

A body which exhibits the images of objects presented to it, by reflection. The word mirror is more peculiarly used to signify a smooth surface of glass, tinned and quicksilvered at the back,\* which reflects the images of objects placed before it.

Are they a modern invention?

The use of mirrors is very ancient: mention is made of brazen mirrors or looking-glasses in Exodus, the 38th chapter and 8th verse. Some modern commentators will not allow the mirrors themselves to have been of brass, but of glass set or framed in brass; but the most learned among the Jewish rabbins do allow that in those times the mirrors made use of by the Hebrew women in dressing their heads were of metal, and that the devout women mentioned in this passage, made presents to Moses of all their mirrors, to make the brazen laver for the Tabernacle. It might likewise be proved that the ancient Greeks made use of brazen mirrors, from many passages in the ancient poets.

*Commentators, explainers of passages in the Bible, &c. Rabbins, doctors among the Jews, their learned men or teachers.*

What nation invented the large looking-glass plates now in use?

The French.

What city of Italy excelled all Europe for many years in the making of fine glass?

Venice. The manufacture of fine glass was first introduced into England by means of Venetian artists in 1078.

Of what is Earthenware composed?

Of clay, and those earths which are capable of being kneaded into a paste easily receiving any form, and

\* See Chapter xiii., article Mercury.

acquiring solidity and hardness by exposure to the fire : sand, chalk, and flint are likewise mixed with clay.

In what manner is it formed into such a variety of shapes ?

The flint or sand, and liquid clay, are mixed together in various proportions for the different kinds of ware, and dried in a kiln ; this paste is afterwards beaten till it becomes fit for being formed at the wheel into plates, dishes, and basins, &c. They are then put into a furnace and baked ; after which they are glazed.

What places have been celebrated for this manufacture ?

Delft, in Holland, was much noted for a particular sort of earthenware, bearing its name ; Faenza and Urbino, in Italy ; Estramos, in Spain ; and Staffordshire, in England.

What nation so greatly excelled in the manufacture of a beautiful species of earthenware ?

The Chinese, who, as far as can be ascertained, were its first inventors. Porcelain was a fine sort of earthenware, chiefly made in China, from whence it was called China or China-ware ; it was also brought into Europe from many parts of the East, especially from Japan, Siam, Surat, and Persia. The art of making porcelain was one of those in which Europe had been excelled by oriental nations ; though for many years past earthenwares have been made in different parts of Europe, so like the oriental, that they have acquired the name of porcelain.

Where were the first European porcelains made ?

In Saxony and France, and afterwards in England, Germany, and Italy, all of which differed from those of Japan and China, while each possessed its own peculiar character. They are now brought to great perfection in Europe, particularly in England and Prussia.

Before the invention of earthenware, what supplied its place to the early inhabitants of the world ?

The more civilised the inhabitants of any country became, the more they would perceive the convenience of possessing vessels of various descriptions for holding or preparing their food ; some of the objects which first presented themselves would be the larger kinds of shells ;

and, in hot climates, the hard coverings of the cocoa-nut or gourd.

What were used in some cases ?

The skins of beasts, as they still are in the East, where they are sewn up, and formed into a kind of leather bottle to hold milk, wine, &c. ; but the people of colder climates could not avail themselves of these natural productions, and were obliged to make use of other substances.

What did they employ ?

Clay—which in many countries is found in great abundance—from its adhesive property, and its retaining its form when dry, and becoming insoluble in water after having been baked in the fire, naturally attracted the attention of an improving people : from this it arises that the early remains of culinary and other vessels which have been discovered have been formed of this material. Among the remains of ancient Egypt, numerous vessels have been found made of common clay baked in the fire ; and, though of rude workmanship, extremely elegant in form.

*Adhesive*, sticking ; one substance adhering closely to another. *Insoluble*, not capable of being dissolved or melted. *Culinary*, belonging to cooking or domestic purposes.

Of what are Needles made ?

Of steel ; and though exceedingly cheap, they go through a great number of operations before they are brought to perfection. It was in the reign of Queen Elizabeth that the English learnt the art of making needles, before which the manufacture had been carried on by foreigners.

Of what are Pins made ?

Of brass wire, blanchèd with tin. The pins most esteemed are those of England and France. Pin-wire is chiefly brought from Stockholm. Though there is scarcely any commodity cheaper than pins, there is no other which passes through more hands before they are fit for use, each pin passing through the hands of above twenty workmen, from the drawing of the brass wire to the sticking of the pin in the paper. Pins are supposed to have been made in England about 1543, or even earlier. Before this art was invented, the ladies made use of wooden skewers.

*Blanched*, whitened.

Of what country is Stockholm the capital?  
Of Sweden.

Of what is Paper made?

Of linen rags, beaten to a pulp in water and moulded into square sheets of the thickness required.

What materials were used for writing before the invention of paper?

Various were the materials on which mankind in different ages and countries contrived to write their sentiments: stones, bricks, the leaves of herbs and trees, and their rinds and barks; tablets of wood, wax, and ivory; plates of lead, silk, linen rolls, &c. At length the Egyptian paper, made of the papyrus, was invented; then parchment, then cotton, and lastly, the common linen paper.

Have not plants sometimes been used for paper and books?

In Ceylon, they wrote on the leaves of the talipot; in India, the leaves of the palm (with which they commonly covered their houses) were used for books. In the West Indies, the leaves of the plantain-tree, dried in the sun, were used for the same purpose, till the French taught the use of European paper. In China, paper is made of the inner bark of the mulberry, the bamboo, the elm, the cotton, and other trees.

What is Papyrus?

A large rush, chiefly growing in Egypt, on the banks of the Nile. The ancient Egyptians made sails, ropes, mats, blankets, and canvas of the stalks and fibres of the papyrus. Their priests also wore shoes made of it; and even sugar was extracted from this plant. The papyrus plant is now, however, exceedingly scarce.

Who was exposed to the Nile in a basket of papyrus?

Moses, the deliverer raised by God to rescue the Israelites from the bondage of Egypt.

Where was the first Paper Mill erected in England?

At Dartford, by a German named Spilman. The only sort made, however, was the coarse brown; and it was not till 1690, when the French Protestant refugees settled in England, that our own paper-makers began to make white writing and printing paper, since which the manufacture



has been brought to great perfection, both for beauty and substance.

*Protestant*, a name given in Germany to those who adhered to the doctrine of Martin Luther, the reformer, because they protested against a decree of Charles V. and applied to a general council. *Refugee*, from refuge, a place of safety from danger, an asylum. Here it more particularly means those French Protestants who were obliged to quit their homes and retire for refuge into other countries, to save themselves from the necessity of abandoning their religion.

How is most of our paper now made ?

From old linen clothes and rags ; and besides those collected in Britain for that purpose, vast quantities are imported from Italy, Germany, Hungary, and Sicily. The imported rags arrive in England in close bags, each bag being marked to show the quality of the rags contained in it. The rags are taken to the mill, where they are again sorted, before the process of paper-making begins. There are now about seven hundred paper-mills in England, and eighty in Scotland.

Is it known to whom we are indebted for the invention of Linen paper ?

Not exactly. It has long been disputed among the learned when and by whom it was invented ; some authors say it was discovered by the Germans, others by the Italians ; others ascribe it to some refugee Greeks at Basil, who took the idea from the making of cotton-paper in their own country : some that the Arabs first brought it among us. Perhaps the Chinese have the best title to the invention, who have for many ages made paper much after the same manner, and in some provinces of the same materials, as hemp, &c.

Are rags the only substance employed ?

The demand for cheap and abundant paper has caused experiments to be made for obtaining paper-pulp from several other substances, as straw, &c. ; and even from old papers that have been written on, by reducing them again to a pulp, and removing the ink and stains by chemical agency. In France, the outer skin of the onion has been manufactured into a delicate writing paper.

In what place was the art of Printing first practised ?

Who were the inventors of European printing, in what city, and in what year it was begun, has long been a sub-

ject of great dispute. Mentz, Haarlem, and Strasburg, cities of Germany, all lay claim to the invention, but Mentz has always had the best title to it.

What was the first Book that was printed from metal types ?

A copy of the Holy Scriptures, which made its appearance between the years 1450 and 1452.

Who introduced printing into England ?

William Caxton, a merchant of London, who had acquired a knowledge of it in his travels abroad.

Of what does printing consist ?

Of the art of taking impressions with ink, from moveable characters and figures made of metal, &c., upon paper or parchment.

What is Parchment ?

Sheep or goat's skin, prepared after a peculiar manner, which renders it proper for several uses, especially for writing on, and for the covering of books. The ancients seem to have used the skins of animals for papyrus and other articles, as a writing material, from a remote period.

From what is the word parchment taken ?

From Pergamena, the ancient name of this manufacture, which is said to have taken its name from the city of Pergamos ; and to Eumenes, king of that city, its invention is usually ascribed, though in reality, that prince appears to have been the improver, rather than the inventor, of parchment, since some accounts refer its invention to a still earlier period of time. Herodotus, an ancient Greek historian, who lived about 450 years before Christ, relates that the ancient Ionians made use of sheep and goat-skins in writing, many ages before Eumenes' time ; the Persians of old, too, wrote all their records on skins, and probably such skins were prepared and dressed for that purpose, after a manner not unlike our parchments, though not so artificially.

In what part of the globe is Pergamos situated ?

Pergamos, or Pergamo, is an ancient city of Natolia, in Asiatic Turkey.

Who were the Ionians ?

The inhabitants of Ionia, in Greece. Ionia was the ancient name of Natolia.

In what manner is parchment prepared ?

The sheep skins are stripped of the wool, which is sold to the wool merchant. They are then smeared over with lime\* on the fleshy side, folded, laid in heaps, and left for some days ; they are next stretched very tight on wooden frames, after having been washed, drained, and half dried.

How is the flesh taken off ?

With iron instruments constructed on purpose, and the skin is then cleansed from the remaining hairs that adhere to it. After having gone through several operations till it is perfectly clean and smooth, it is fit for writing upon. Parchment is made in most of the cities of France, and vast quantities are imported into England, Flanders, Holland, Spain, and Portugal.

What are the uses of parchment ?

Parchment is of great use to lawyers and others for writings which are to be preserved, on account of its great durability ; the writing on it remaining perfect and undecayed for a great number of years. It is also used for the binding of books, and various other purposes.

What is Vellum ?

A thicker and finer sort of parchment than the former, but prepared in the same manner, except that it is not passed through the lime pit. It is made of the skin of very young calves ; there is also a still finer sort made of the skin of a sucking lamb, or kid ; this is called *virgin* parchment, and is very thin, fine, and white, and is used for fancy-work, such as ladies' fans, &c.

## CHAPTER VIII.

CAPERS, ALMONDS, ORANGES, LEMONS, CITRONS, LIMES, OLIVES,  
OILS, MELONS, TAMARINDS, DATES, AND POMEGRANATES.

What are Capers ?

The full-grown flower-buds of the caper-tree, a small shrub, generally found growing out of the fissures of rocks, or among rubbish, on old walls and ruins, giving them a gay appearance with its large white flowers. It is a native

\* See Chapter xvi., article Lime.

of Italy and Sicily: it is also common in the south of France, where it is much cultivated. The caper was introduced into England as an exotic, as early as 1596; but the climate is too cold for it to grow, except in gardens in a warm situation.

How are they prepared and for what are they used?

They are gathered and dried in the shade; then infused in vinegar, to which salt is added; after which they are put in barrels, to be used as a pickle, chiefly in sauces.

What are frequently substituted for capers in England?

The buds of broom pickled in the same manner, or the berries of the nasturtium, an American annual plant, with pungent fruit, but common in our gardens.

What are Almonds?

The nut of the almond-tree, a species of the peach, growing in most of the southern parts of Europe; there are two kinds, the bitter and the sweet.

What are their qualities and use?

The sweet almonds are of a soft, grateful taste, and much used by the confectioner in numerous preparations of sweetmeats, cookery, &c. Both sorts yield an oil, and are useful in medicine.

Of what country is the Orange a native?

It is originally a native of China, India, and most tropical countries; but has long been produced in great perfection in the warmer parts of Europe. Oranges are imported in immense quantities into Britain every year, from the Azores, Spain, Portugal, Italy, &c. They are brought over in chests and boxes, packed separately in paper to preserve them. The oranges in common use with us are the bitter or Seville, and the China or sweet orange; but there are many varieties.

Where are the Azores situated?

In the Atlantic Ocean, about 800 miles from Portugal. These islands are very productive in wine and fruits.

Where is Seville?

In Spain; it is an ancient and considerable city, the capital of the province of Andalusia. The flowers of the Seville orange are highly odoriferous, and justly esteemed one of the finest perfumes. Its fruit is larger than the

China orange, and rather bitter; the yellow rind or peel is warm and aromatic. The juice of oranges is a grateful and wholesome acid.

*Odoriferous*, sweet scented, fragrant; having a briak, agreeable smell, which may be perceived at a distance.

Who first brought the China orange into Europe?

The Portuguese. It has since been cultivated in the warm parts of Europe. It is said that the very tree from which all the European orange-trees of this sort were produced, was still preserved a few years back, at the house of the Count St. Laurent, in Lisbon. In India, those most esteemed, and which are made presents of as rarities, are no bigger than a billiard ball. The Maltese oranges are said by some to be the finest in the world.

Who are the Maltese?

The inhabitants of Malta, an island of the Mediterranean, situated between Africa and Sicily.

Whence are Lemons brought?

The Lemon is a native of Eastern Asia, from whence it was brought to Greece, and afterwards to Italy; from Italy it was transplanted to Spain, Portugal, and the south of France, whence lemons are imported to England in great plenty.

What is the Citron?

The citron is larger than the lemon, and distinguished from the common lemon not only in size, but in its pulp being finer. The citron was also brought originally from the east of Asia, but has since been produced in the warm parts of Europe, like the orange and lemon; Genoa especially is the greatest nursery for them. Its rind is principally brought to this country in a candied state, and is applied by confectioners to various purposes.

Where is Genoa?

In Italy, of which country it is a province, having a capital city of the same name.

What is the Lime?

The lime is by some thought to be a species of lemon, by others not; it is a smaller fruit, and in the West Indies is greatly preferred to the lemon. It is cultivated in the south of Europe, the West Indies, and the warm parts of

America. The agreeable scent called Bergamot is prepared from the rind of a small species of lime.

What are Olives ?

The fruit of the olive-tree, an evergreen, now common in the woods of France, Spain, and Italy ; but in this wild state producing a small fruit of no value ; when cultivated, however (which it is extensively, both for the fruit and the quantity of oil which it yields), it forms one of the richest productions of the south.

Whence came the olive originally ?

From Asia, but it is naturalised in many parts of Southern Europe. The use of the olive is very ancient ; it is frequently spoken of in the Bible, both as in a wild and cultivated state. The promised land of the Israelites was "a land of oil, olive, and honey." From the time that the dove returned to Noah in the Ark with an "olive leaf plucked off," in all ages and countries, wherever this tree is known, down to the present day, has an olive branch been the favourite emblem of peace.

What nation holds the olive in great repute ?

This tree was a great favourite with the ancient Greeks, and scarcely an ancient custom existed in which the olive was not in some way associated ; at their marriages, and at festivals, every part of their dwellings, especially the doors, were ornamented with them, and the same custom prevails at the present day, both in public and private rejoicings. It was also scarcely less a favourite with the Romans, although it was not held in the same sacred light as amongst the Greeks.

What has the olive branch been universally considered ?

As an emblem of plenty, and as such it is found on the coins of those countries of which it is *not* a native. Two centuries after the foundation of Rome, both Italy and Africa were strangers to this useful plant ; it afterwards became naturalised in those countries, and at length arrived in Spain, France, &c. Olive-trees sometimes attain to a great age.

How are the olives eaten ?

The olives while on the tree are intolerably bitter, without any of that peculiar taste which gains them admit-

tance at the richest tables : to fit them for which they are pickled. Ripe olives are eaten in the Eastern countries, especially amongst the Greeks, as an article of food, particularly in Lent. The oil, which they yield in great quantities, is the most used and the most esteemed of all others ; being that chiefly used for salads, &c., in medicine, and in various manufactures.

*Lent*, a time of fasting ; the time from Ash-Wednesday to Easter.

How is the oil drawn from the olive ?

By presses or mills made for the purpose. The sweetest and best olive oil comes from the south of France, and the kingdom of Naples, Florence, and Lucca ; quantities are also brought from Spain and the Ionian Islands.

Where is Naples ?

In the south of Italy.

Where are Florence and Lucca situated ?

In Italy. Florence is a very ancient, large, and celebrated city of Tuscany, a considerable state of Italy, anciently called Etruria ; Lucca is a small province or republic, with a capital of the same name, near the Tuscan sea.

*Republic*, that state in which the supreme power of government is shared by many, instead of being vested in an emperor or king.

You said that the olive is an evergreen : to what plant or shrub is the term particularly applied ?

To any shrub or tree whose leaves continue fresh and green all the year round, winter and summer, as the laurel, bay, holly, &c., which do not shed their leaves in autumn as other trees.

Is Oil a production confined to the olive alone ?

By no means. Oil is a fatty, inflammable matter, drawn from many vegetable and animal bodies. The oils in common use are of three different kinds. The first are mere *oily* or fatty bodies, extracted either by pressure, or by decoction : those of almonds, nuts, or olives, are obtained by pressure ; those drawn from different berries, &c. are procured by boiling the substance in water, which causes the oil to collect on the top.

*Decoction*, act of boiling—a chemical term.

What are the second and third kinds of oils ?

The second are those drawn from vegetables, by common distillation in the alembic, with the aid of water; these contain the *oily* and volatile part of the plant, and are called *essential* oils. The third sort are those produced by distillation, but of a different kind, in an open vessel, without the help of water.

*Distillation*, the act of distilling,—that is, collecting or letting fall in drops. *Alembic*, a chemical vessel used in distilling. It consists of a vessel placed over a fire, containing the substance to be distilled, covered with a hollow kind of lid, with a beak or spout, into which the steam rises and passes into a twisted pipe placed above it. *Volatile*, easily escaping, quickly flying off.

How are they likewise divided?

Into *vegetable*, *animal*, and *mineral* oils; which last are those drawn from amber, and a few other substances partaking both of the vegetable and mineral natures, and supposed to have been of *vegetable* origin. The *true* mineral, however, has not the smallest particle of *oil*; and in *this* consists the essential difference between them and vegetable and animal bodies.

Of what does oil consist?

The parts of which oil is composed are, an inflammable principle, an acid, water, and earth; for all these principles have been discovered in the decomposition of any oil. There are also *oils* produced by chemical action, as oil of wine, &c.

*Decomposition*, act of separating the parts of which a body is composed. *Acid*, sour, tart.

Whence is the word *oil* derived?

From the Latin *oleum*, formed from *olea*, *olive-tree*, the fruit of which abounds in oil.

What makes the distinction between oils and fats?

*Oil* is liquid at the ordinary temperature, and common to both animals and vegetables. *Fats* are solid at the ordinary temperature, and belong chiefly to animals.

What other constituents have these oils and fats besides those you have named?

Stearine or suet, and its acid, called stearic; margarine, a principle found in spermaceti, mutton suet, and stearic acid, and its acid, called margaric; oleine, the greatest part of the fat, oils, and most of the solid fats, and its



acid, oleic; and the syrupy body called glycerine, which is the base of the three.

*Margarine*, from the Greek for pearl, so named from its pearly lustre. *Oleine* and *oleic*, from *oleum*, oil. *Glycerine*, from a Greek word signifying, sweet matter.

How long has this last principle been discovered?

Not before 1789. Scheele, a celebrated German chemist, discovered it, and called it the "sweet principle of oils." Twenty-five years afterwards, Chevreuil, the French chemist, studied it, and found it to be the base of fats and oils; but it has only come into use since 1844, before which hundreds of tons have been yearly thrown away among the waste liquors from soap\* and candle† making.

To what use is Glycerine put?

Pure, distilled glycerine is used for medicinal purposes, especially in skin diseases, for its stimulating and softening properties; to preserve objects of natural history, as fruit, flowers, insects, and even animal specimens, because of its resistance of putrefaction; in making an excellent soap for the skin, and many purposes in the arts; its uses, as it becomes more understood, promising to be more and more varied.

Describe it more minutely.

It is a fluid, saccharine matter found in animal fats and oils, and produced during their mixture and combination with alkalies, earths, or oxides.

What are its chemical properties?

It mingles readily with fluids, even with oils; it dissolves vegetable acids, the numerous salts, sulphates, nitrates, alkaline compounds, and other chemical preparations, even oxide‡ of lead, or holds them in *suspension*.

*Sulphate*, the acid of sulphur, mixed with some other body. *Nitrate*, a compound of nitric acid,§ with a salt as a base. *Alkaline*, belonging to an alkali, as soda.

What is meant by Suspension?

A chemical term applied to solid bodies whose particles do not dissolve in water, but float in it, and may be separated by *filtration*, which signifies the straining of

\* See Chapter xii., Soap. † Ditto, article Candles.

‡ See Oxide Chapter x. § See Nitre, Chapter xii., article Saltpetre.

fluids through linen, paper, &c., to separate them from other substances floating in them.

How are these suets, acids, &c., obtained from oily or fatty bodies ?

By chemical decomposition. In 1825, the celebrated French chemists, Chevreuil and Gay-Lussac, conceived the idea of obtaining them by distillation. Since 1840, this process has been adopted in England and France, and the materials obtained therefrom used in the making of candles and soaps.

Is the oil called *castor*, which is so much used in medicine, the product of an animal or a plant ?

Castor oil is expressed from a West Indian shrub called *Palma Christi*; and especially from the ripe seeds, which are full of this oil. It is prepared by collecting these ripe seeds, and freeing them from the husks; then bruising and beating them into a paste; they are next boiled in water, when the oil rising to the surface is skimmed off as it continues to appear. The castor oil plant is found growing abundantly in Sumatra, particularly near the sea-shore.

Where is Sumatra situated ?

In the Oriental Archipelago, off the southern part of the continent of Asia.

In what other countries is this plant found ?

In some parts of Africa, Syria, and Egypt. It was anciently cultivated in the two last-mentioned countries, in large quantities, the seeds being used for the oil they yielded, which was burnt in lamps.

Is not the *Palma Christi* much affected by soil and situation ?

Greatly so. In some places it attains the stature of a tree, and is not a biennial plant, but endures for many years, as in the warm plains of Irak-Arabi, and some parts of Africa.

*Biennial*, lasting for the space of two years only.

What immense fish is it that furnishes us with a quantity of animal oil ?

The Whale, the largest and noblest inhabitant of the water. It is protected from the cold by a case or coating of blubber, that is, a thick oily fat, which is very valuable

for many purposes, and causes numbers of them to be caught for the sake both of that and their bones, which are very useful in the manufacture of umbrellas, &c.

In what part of the sea are they found ?

Chiefly in the Northern Seas : extensive whale fisheries are carried on by the English, Dutch, &c., and numbers of vessels are sent out for the purpose of taking the fish : they usually sail in the latter end of March, and begin fishing about May. The whale fishery continues generally from that time till the latter end of June or July. There are also other fishes and animals which afford us oils of different kinds, which are used for various purposes in medicine and the arts. Animal oils are obtained by the action of heat upon the fat.

What are Melons ?

A species of the *cucumis*, a genus of plants to which the cucumber belongs. There are great varieties of this fruit cultivated in different parts of the world ; that sort called the Cantaleupe melon (so named from being cultivated at a place of that name in the neighbourhood of Rome, whither it was brought from Armenia), when ripe, is juicy and delicious.

*Genus*, a class containing many species or kinds.

Where is Armenia situated ?

Armenia is a large country situated in Asiatic Turkey, to the west of the Caspian Sea.

What species of melon is that which almost makes up for a scarcity of good water in hot countries ?

The water melon, which affords a cool, refreshing juice, and quenches the thirst produced by the excessive heats. It grows in great abundance in Turkey, Little Tartary, Palestine, Syria, &c., proving an agreeable and useful substitute when good water is difficult to be obtained.

*Substitute*, serving instead of another.

What are Tamarinds ?

The fruit of the tamarind-tree, a native of both the Indies, Asia, Africa, &c. It is of a roundish form, and composed of two pods enclosed one within the other, between which is a soft pulpy substance, of a

tart but agreeable taste ; the inner pod contains the seed or stones.

*Tart, sharp, acid.*

For what are they used ?

We use them only as medicine ; but the Africans, and many of the Oriental nations where they are common, make them into a kind of preserve with sugar, which they eat as a delicacy to cool them in the violent heats of their climate.

From what nation was the knowledge of their use in medicine obtained ?

From the Arabians.

What does the word Oriental signify ?

Belonging to the East : therefore those countries of the globe situated in the East are called Oriental, those in the West, Occidental ; from *Oriens*, signifying East, and *Occidens*, West.

What are Dates ?

The fruit of the palm, a beautiful and graceful tree, peculiar to the warmer regions of the globe ; the growth of the palm is extremely singular, for although some species attain the height of the largest forest trees, their structure differs materially from that of a tree, properly so called. The leaves of the young plant arise directly from the surface of the ground, and there is no appearance of any stem for several years ; this stem once formed, never increases in size, the growth of the plant being always upward, so that the stem itself is formed by the former growth of the green portions of the palm.

*Structure, the manner of formation.*

How often does this tree cast its circle of leaves ?

Every year ; so that the number of years a palm has existed is known by the scars which are left by their falling off. The palm is an evergreen.

What are the uses of this tree ?

The palm is of the utmost importance to the inhabitants of the tropical regions ; the fruit and sap providing them with food, the fibrous parts with clothing, and the leaves forming the greatest part of their slightly-constructed huts ; the leaves of some species are formed into fans,

hats, and parasols; others are written on, in the same manner that we write on paper; artificial flowers are made of the pith of some; the light and supple rattan walking cane is the slender shoot of another kind; and solid and useful utensils are made of the shell of the cocoa-nut. The fibres of the date palm are formed into ropes and twine; a liquor is drawn from the trunk, called palm wine; the trunks of the old trees furnish a hard and durable wood; and even the nuts or stones of the fruit are useful for feeding cattle; a wholesome flour is also made of the fruit, when dried and reduced to powder.

*Constructed*, put together.

From whence is its name derived?

From the Latin word *palma*, a hand, given to these productions of the vegetable world, from the supposed resemblance of their broad leaves to the human hand. On the same account the date, the fruit of the date palm, is called, from the Greek, *dactylus*, a finger, because it grows in clusters, spreading out like the fingers of the hand. The palm sometimes forms impenetrable forests; but more frequently is found scattered to the number of two, three, or even one, beside the springs and fountains of water, affording a kindly shade to the thirsty traveller.

*Impenetrable*, not easily penetrated or got through.

From what countries are dates brought?

From Egypt, Syria, Persia, Africa, and the Indies. Among the Egyptians and Africans, they make a principal article of food. Dates, when ripe, are of a bright coral red, of an oblong form, and possess a sharp biting taste: they are usually gathered in autumn, before being perfectly ripe.

What are Pomegranates?

The fruit of an Eastern tree. It grows particularly in Palestine and Northern Syria. The flowers are of a beautiful red, and come at the end of the branches. They continue in blossom long after other trees have shed their flowers, and thus add to the brilliancy of an Eastern garden.

Of what form is the fruit?

Something like an orange; its colour is a ruddy brown: within are a number of red, shining seeds.

What are its uses?

The seeds are used to colour sherbet, and its juice, which is rich and refreshing, is used for making that famous Eastern beverage. The whole fruit is very valuable in cookery.

Is there anything remarkable attached to the pomegranate?

It was among the good things promised to the Israelites in the land of Canaan. Its figure was profusely employed in the ornaments of the temple and the priestly garments.

## CHAPTER IX.

### HATS, STOCKINGS, SHOES, GLOVES, LEATHER, FURS, AND INK.

Of what are Hats made?

Of wool, or the hair of divers animals, as the hare, rabbit, camel, &c., worked, fitted, and fashioned to the form of the head; also of the hair of an amphibious animal, called the castor or beaver, a native of Canada and other provinces of North America. Others are made of straw, platted and sewn together; and a great number of silk, woven with the threads loose upon the surface, in imitation of the beaver fur.

What other process do hats undergo before they are complete?

Both the beaver and silk hats must be dyed, &c.; the silk hats, which have now almost superseded the use of beaver, are made with frames of cork or other light fabrics, upon which the piece of silk is tightly stretched.

When did hats come into general use?

The first mention made of hats is about the time of the Saxons, but they were not worn except by the rich. Hats for men were invented at Paris, by a Swiss, in 1404. About the year 1510, they were first manufactured in London by Spaniards. Before that time both men and women in England commonly wore close, knitted, woollen caps. They appear to have become more common in the reign of Queen Elizabeth. It is related that when Charles

the Second made his public entry into Rouen, in 1449, he wore a hat lined with red velvet, surmounted with a plume or tuft of feathers; from which entry, or at least during his reign, the use of hats and caps is to be dated; and from that time they took the place of chaperoons and hoods, that had been worn before in France.

Where is Rouen?

In the province of Lower Seine, in France; it was formerly the capital of Normandy.

Describe the Castor or Beaver, and its habits.

The beaver has a broad, flat tail, covered with scales, serving as a rudder to direct its motion in the water; the toes of its hind feet are furnished with membranes, after the manner of water-fowl; the fore feet supply the place of hands, like those of the squirrel. The Beaver has two kinds of hair, of a light brown colour, one long and coarse, the other short and silky. The teeth resemble those of a rat or squirrel, but are longer, and admirably adapted for cutting timber or stripping the bark off trees, for which purpose it uses them continually.

*Membranes,* thin, flexible, expanded skins, connecting the toes of water-fowl and amphibious animals, which enable them to swim with greater ease.

Where do beavers usually fix their habitations?

Their houses are always situate in the water; they are composed of clay, which they have worked up into a kind of mortar with their paws: these huts are of an oval figure, and divided into three partitions, which are raised one above another and erected on piles, which they drive into the mud; their teeth are so strong that they fell trees with them, and cut them into pieces for that purpose. Each beaver has his peculiar cell assigned him, the floor of which he strews with leaves or small branches of the pine-tree. The whole building is generally capable of containing eight or ten inhabitants.

On what does the beaver feed?

Its food consists of fruit and plants, and in winter it eats the wood of the ash and other trees. The hunters in America kill vast numbers for their skins, which are sent over in quantities to Europe.

Of what are Stockings made?

Of cotton, silk, or wool, woven or knitted. Anciently, the only stockings in use were made of cloth, or stuff sewn together; but after the invention of knitting and weaving stockings of silk, wool, and cotton, these were discontinued.

From what country is it supposed that the invention of silk knitted stockings originally came?

From Spain in 1589. The art of weaving stockings in a frame was said to be invented by William Lee, M.A., of St. John's College, Cambridge, a native of Woodborough, near Nottingham.

Explain the signification of M.A.

Master of Arts, a degree of honour conferred by the universities.

What are Shoes?

A covering for the foot, now usually made of leather, stuffs, satin, &c. In different ages and countries shoes have been made of various materials, as raw skins, rushes, broom, paper, silk, wood, iron, silver, and gold. Wooden shoes are still worn by many of the peasants of Europe.

What nation wore shoes made of the bark of the papyrus?

The Egyptians. The Turks always take off their shoes and leave them at the door when they enter the Mosques, or their dwelling-houses. The same custom also prevails among other Eastern nations.

What is a Mosque?

A Mohammedan church or temple.

What is meant by Mohammedan?

Belonging to the religion of Mohammed, the warrior and prophet of Arabia and Turkey, who was also its founder. He was born at Mecca, a city of Arabia, in 571, and died in 631 at Medina, a city situated between Arabia Felix and Arabia Deserta. His creed maintains that there is but one God, and that Mohammed is his Prophet; it enjoins observance of prayers, washings, almsgiving, fasting, sobriety, pilgrimage to Mecca, &c.

What do the appellations of Felix and Deserta signify?

Arabia, a country of Asia, lying on the borders of the Red Sea, is divided by Europeans into Petræa, Deserta, and Felix; Petræa signifying the Stony, Deserta the



Desert, and Felix the Fortunate or Fruitful, according to the nature of the soils so named.

What is Leather ?

The skins of various animals, as oxen, cows, calves, &c., dressed and prepared for different manufacturers, whose business it is to make them up according to their different employments.

How is the leather prepared ?

By tanning—that is, preparing the skins in a pit filled with tan and water, the hair having been first taken off by steeping them in lime-water.

What is Tan ?

The bark of oak-tree, &c., chopped and ground by a tanning mill into a coarse powder.

What is Lime ?\*

A white, soft, friable, earthy substance, prepared from stone, marble, chalk, or some other stony substance by burning in a kiln.

*Friable*, easily powdered.

For what is it used ?

Its greatest use is in the composition of mortar for building ; it is also much used by tanners, skinners, &c., in the preparation of their leather ; by soap-boilers in the manufacture of soap ; and by sugar-bakers for refining their sugar.

What is a Kiln ?

A stove formed for admitting heat in order to dry or burn materials placed in it.

Of what are Gloves made ?

Of leather, silk, thread, cotton, worsted, &c.

What skins are generally used for gloves ?

Those of the chamois, kid, lamb, dog, doe, and many others.

What are Furs, and how are they prepared ?

Furs are the skins of wild animals, dressed with the hair on, and used as apparel, either for warmth, ornament, or distinction of rank or dignity. The robes of kings, dukes, and peers, are frequently lined with different kinds of fur, especially ermine or sable, to render them more magnifi-

\* For a further account of it, see Chapters xiii. and xvi.

cent. Also those of several chief magistrates, judges, and doctors of different faculties and degrees in the universities. The skins are prepared with alum and other ingredients, to preserve and purify them.

Are those furs which are generally used for dress and ornament the production of our own country?

No; most of these furs are brought from foreign countries. At first the northern parts of Asia supplied us with them; but now we send furs, by means of our possessions in North America, in immense quantities, to China, &c.

Name a few of the principal furs in use.

The ermine, the fur of an animal of the same name, a native of the cold regions of Europe and Asia. North America also produces an animal identical with the ermine; it is called the stoat, but its fur is greatly inferior in value. The sable is another animal much prized for its rich fur; it is a native of northern Europe and Siberia. The skins of the marten, found in North America, as well as northern Asia and the mountains of Kamtschatka; and also of various kinds of bear, fox, racoon, badger, lynx, musk-rat, rabbit, hare, and squirrel, which are all procured in North America. One of the most valuable descriptions of fur is that of the beaver.

How are they procured?

By hunting the animals, which is the employment both of natives and settlers from other countries; the hunters sell the skins for money, or more frequently exchange them for clothes, arms, and other articles which may be useful, to companies established for the purpose of trading in furs; these import them into other countries. These companies, of which there are a great many, are named after the places where they are established, or the countries to which they belong.

What is Alum?

A kind of mineral, of a strong, sharp taste. In Italy it is obtained from a soft, reddish stone, about Puteoli; from several kinds of earth; and in England, from a whitish or bluish stone, called Irish slate.

What are its qualities?

It dissolves both in cold and boiling water, but best in the latter. It is of some use in medicine; a principal in-

gredient in dyeing and colouring,\* neither of which can be well performed without it, as it sets and brightens the colours, and prevents them from washing out. It is also extremely useful in many arts and manufactures.

Are there not different sorts of this mineral ?

The principal kinds are native alums : viz. those prepared and perfected underground by the spontaneous operations of nature ; as the roch, commonly called rock alum, from Rocha, in Syria, whence it is procured ; and another sort prepared from earths or stones. Alum is procured in various ways, according to the nature of the mineral employed. There are alum works in England, chiefly in Yorkshire. In Italy, &c., the finest and best alum is procured from those in the Roman territory. A native alum has been dug out of the coal mines near Whitehaven, in Cumberland. True alum was first discovered and prepared by the Orientals, about the fourteenth century.

*Spontaneous*, voluntarily, naturally, unassisted by art. *Orientals*, inhabitants of the Eastern parts of the world. *Territory*, dominions belonging to a particular kingdom.

What is Ink ?

A liquor used in writing on paper or parchment, made from copperas, galls, and gum arabic† mixed together. There are likewise several plants that may serve for the making of ink, as oak-bark, red roses, logwood,‡ &c. It is also made from an infusion of oak galls and iron filings : there are also many other different ways, as well as materials, employed in the making of this useful article.

What is understood by this term ?

Any liquid used in writing, of whatever colour it may be, as red, blue, &c., though black is the most used for common purposes. The ink of the ancients seems to have been of a thick, oily nature, unlike the modern ink ; it consisted of nothing more than a species of soot, or ivory black, mixed with one-fourth of gum.

*Infusion*, a liquor made by steeping anything in water, or other liquids, without boiling ; in opposition to decoction.

What is Copperas ?

\* See Chapter xv., article Logwood. † See Chapter xi.

‡ See Chapter xv., article Logwood.

A kind of vitriol. Copperas is the name given by the manufacturers to green vitriol, which is prepared from iron. There are different kinds of copperas, as those of England, Germany, Hungary, Italy, and Cyprus, which all differ from each other in colour, richness, and perfection. It is likewise found in earth, stones, &c.

Where is Cyprus?

Cyprus is a large and fertile island, situated in the Levant.

What are the different kinds?

White copperas, a vitriol of iron, mixed with another mineral, called zinc, is brought from Germany, in large cakes or lumps. Green vitriol, or English copperas, is made from a kind of stone found on the sea-shore, in Essex, Hampshire, and the western coast, commonly called gold stones, from their colour; these stones abound in iron: Hungarian and Cyprus copperas are of a sky blue, and partly composed of copper: that of Italy is green.

What are the properties of Vitriol?

It dissolves in water, melts and calcines by fire; and is always composed partly of some metal, as copper, zinc, iron, &c., an acid, and water. It is not inflammable; but so highly corrosive as to destroy the skin.

*Calcine*, to burn to a calx, or friable substance. *Corrosive*, sharp, biting. *Inflammable*, easily catching fire.

You say that green vitriol is a preparation from iron; what are the white and blue vitriols?

White vitriol is a combination of sulphur and zinc; blue vitriol, of sulphur and the black oxide\* of copper. All these are prepared for use in the different arts by dissolving them in an acid, generally sulphuric acid.

For what else is vitriol used?

In the making of glass, to colour it; in many arts and manufactures, and in medicine.

What are Galls?

Excrescences or distortions of part of a leaf or stalk of any tree or plant, formed by an insect which lives and grows within them. Many of them are used in chemistry, dyeing, making of ink, and other compositions. There

\* See Oxide, Chapter x..

are two sorts of oak galls in our shops, brought from the Levant, and the southern parts of Europe.

What does the word Levant signify?

In speaking of trade, ships are said to come from the Levant when they come from Natolia, Syria, Palestine, Egypt, and the adjacent parts. The Levant Sea comprehends the eastern part of the Mediterranean.

Is the Ink used in printing the same as writing ink?

No; it is more of the nature of paint, being thicker and more glutinous; it chiefly consists of a mixture of oil and lamp black, or some other ingredient, according to the colour required; and is remarkable for the ease with which it adheres to paper that is thoroughly moistened.

*Glutinous, gummy, ropy.*

What is Indian, or Chinese Ink?

An admirable composition, not liquid like our ink, but solid, and made into cakes something like the mineral colours we use in painting. It is made into all sorts of figures, usually long, and about an inch thick; some of them are gilt with the figures of birds, flowers, &c. In using this ink, it is rubbed with water, on stone or earthenware, till it produces a beautiful, liquid, shining black. It is brought from China. It is composed of lamp black and size, or animal glue, or gum, to which perfumes and other substances are sometimes added.

## CHAPTER X.

ASBESTOS, SALT, COAL, IRON, COPPER, BRASS, ZINC, AND LAPIS CALAMINARIS.

What is the name of the remarkable stone of which a cloth has been made that resists the action of fire?

The Asbestos, a mineral substance of a whitish or silver colour. There are several species of this mineral, which are distinguished by different names, according to the appearance of each, as fibrous asbestos, hard asbestos, and woody asbestos; it is the fibrous sort which is most noted for its uses in the arts.

*Fibrous, full of fibres or threads.*

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Do the terms Mineral and Stone signify the same ?

Not exactly ; by minerals are meant all metals or metallic substances, whether pure or mixed with others ; in which latter state they are called ores. Stone is a hard substance, composed of earth, incapable of dissolving in water, and neither ductile nor malleable like a great many of the minerals.

*Ductile*, capable of being drawn out to any length without breaking.

*Malleable*, capable of being beaten into any shape with the mallet or hammer.

To which of these two substances does the asbestos belong ?

To the mineral. It is usually found enclosed within very hard stones ; sometimes growing on their outside, and sometimes detached from them.

What are its qualities ?

It is insipid to the taste ; will not dissolve in water ; and exposed to the fire, it neither consumes nor calcines. The industry of mankind has found a method of working upon this untoward mineral and employing it in the making of cloth and paper ; the process is however difficult.

*Insipid*, without taste.

Was not this curious mineral better known to the ancients than it is at present ?

The linen made from it was highly esteemed by them ; it was not only better known, but more common, than among us, being equally valuable with the richest pearls. The superiority of all other cloths to this in every other respect, except the resistance of fire, has caused incombustible cloth to be regarded in modern times merely as a curiosity, but it is still employed in chemical preparations.

*Incombustible*, remaining undestroyed in fire.

To what use did they put it ?

In royal funerals, it formed the shroud to wrap the body in, that its ashes might be preserved from mingling with the wood, &c., that composed the pile. Some of the ancients made themselves clothes of it, particularly the Brahmins among the Indians ; it formed wicks for their perpetual lamps ; thread, ropes, nets, and paper, were also made of it. Pliny, the Roman naturalist, says he has seen

napkins of asbestos taken soiled from the table after a feast, which were thrown into the fire, and by that means better scoured than if they had been washed with water.

*Naturalist*, a person who studies nature, especially in what relates to metals, minerals, stones, vegetables, and animals. *Brahmins*, Indian priests.

Where is the asbestos found ?

This mineral is found in the greatest quantity in the silver mines of Saxony ; at Bleyburg, in Carinthia ; in Sweden, Corsica, and sometimes, though not so often, in France and England ; also in Tartary, Siberia, and America.

Where are Saxony and Carinthia situated ?

Saxony is a kingdom of Germany, and Carinthia a duchy of the same.

What method is used in preparing the asbestos ?

The stone is laid in warm water to soak, then opened and divided by the hands, that the earthy matter may be washed out. This washing is several times repeated, and the flax-like filaments collected and dried ; these are easily spun with the addition of flax. The cloth when woven is best preserved by oil from breaking or wasting ; on exposure to the fire, the flax and the oil burn out, and the cloth remains of a pure white. The shorter threads, which separate on washing the stone, may be made into paper in the usual manner.

What is Salt ?

In a popular sense, it denotes a saline crystallisation of a sharp, pungent taste and cleansing quality, used to season flesh, fish, butter, and other things requiring to be kept. Salt easily dissolves in water, and melts in fire, but congeals again when cold ; it is friable, pellucid, and of an acrid taste.

*Popular*, familiar, suitable to the common people. *Saline*, consisting of salt. *Congeval*, to freeze, to harden. *Pellucid*, clear, transparent.

In what state are salts generally found ?

Some salts are found solid and pure, either in the earth, or on its surface ; others embodied in earth or stones ; others in a fluid state in water.

What is that called which we put to the most common use ?

Marine salt. Salts are divided into three different

sorts, namely, fossil, or rock salt ; sea, or marine salt ; and spring salt, or that drawn from briny springs and wells.

*Marine*, belonging to the sea. *Briny*, consisting of brine ; which means water tasting of salt : it is used to signify the waters of the sea, or *any* salt water.

What is Fossil or Rock Salt ?

That which is found in large beds in the bowels of the earth (sometimes, but more frequently in irregular masses of red, yellow, or blue colours), and which has not undergone any artificial preparation ; this salt was entirely unknown to the ancients, who by rock salt meant that which adheres to the rocks above high-water mark, being lodged there by the spray of the sea, which is evaporated by the heat of the sun ; this is the purest salt of all others for chemical purposes, and is to be found off the rocks of Sicily, and several islands of the West Indies.

*Artificial*, produced by art and the labour of man. *Evaporated*, flown off, and escaped in fumes or vapours.

What is Marine Salt ?

That salt which is made from sea water, thickened by repeated evaporations, and at length crystallised ?

What is Spring Salt ?

That salt which is not made from sea water, but from the water of salt wells or springs ; quantities of this salt are made in most inland countries, as in Germany, Switzerland, Hungary, and in some parts of France and England.

In what manner is it prepared ?

The means employed for extracting the salt from the water vary according to circumstances. In hot countries, such as Spain, &c., the sea water is merely exposed to the action of the sun, until the water is evaporated ; the salt procured by this means is considered the best for preserving animal food ; it is called *bay* salt.

What method is usually employed in countries where the sun's heat is not sufficiently powerful ?

In climates such as England, where the rays of the sun do not afford sufficient heat, the sea water which has been partly evaporated in large shallow reservoirs formed in the earth, called salt pans, is poured into enormous coppers



and boiled for four or five hours. When the contents of the copper are wasted to half the quantity, the liquid begins to be crystallised; the vessel is again filled up, and the brine again boiled and purified: this is repeated three or four times. After the last purifying, the fire is kept very low for twelve or fourteen hours; when the moisture is nearly evaporated the salt is removed, and after the remaining brine has drained off, placed in the storehouses.

In what countries is salt generally found?

This substance, so necessary to the comfort of mankind, is widely distributed over the face of the earth, and nothing, except, perhaps, the air we breathe, is more easily within our reach. The ocean is an exhaustless storehouse of this valuable article. Those nations of the earth who are placed at a distance from the sea, find their country provided with magazines of salt, either in solid masses, or dissolved in the waters of inland lakes, or issuing from the solid rocks in springs of brine.

Name the countries most noted for mines of salt:

Poland, Upper Hungary, and the mountains of Catalonia, have extensive salt mines: those in the village of Wilizka, in Poland, about five leagues from Cracow, are of a surprising depth and size. England has its salt springs and mines: the mines of salt near Northwich, in Cheshire, were discovered in 1670, as they were boring for coal. In the interior of Hindostan, there is a remarkable salt lake; and in several parts of the globe there are spots of ground impregnated entirely with this substance; an island of the East Indies contains a singular kind of fossil, or native dry salt; the soil there is in general very fruitful, but in certain parts of the island, there are spots of ground entirely barren, without the appearance of anything vegetable upon them; these spots taste very salt, and abound with it in such quantities, as to supply not only the whole island, but the greater part of the adjacent continent.

*Fossil*, the remains of minerals or shells dug from the earth. *Impregnated*, filled, saturated. *Catalonia*, a considerable province of Spain, situated to the north-east. *Adjacent*, the neighbouring, adjoining part, near by.

Is the New World as well supplied with this useful substance?

Yes; America abounds with salt springs, especially in New York, Virginia, and Pennsylvania. There are also large plains of it near the great Salt Lake.

To what use did the ancient inhabitants of Africa and Arabia put this substance?

The large slabs of rock salt, with which their country abounds, were employed by them instead of stones, in building their dwellings, the pieces being easily cemented together by sprinkling the joints with water, which melting the parts of the two surfaces that opposed each other formed the whole, when dry, into one solid block.

Does rock salt undergo any preparation before it is used?

Yes; when taken from the earth it is broken small, and dissolved in cold water, and afterwards drawn off into salt pans, and refined in the same manner as the sea salt.

Are these the only kinds of salt?

Salts, like acids, are a most numerous class of bodies; they are present in earths, metals, animals, vegetables, &c. There are *native* salts and *artificial* salts. The first are mineral bodies, as rock salt; the second are produced by chemical process from different substances, as salt of iron, lead, &c.

Are salts simple or compound bodies?

A salt is always a compound of an acid with an alkali, a salt, or an oxide, in various proportions. There are two great classes of salts, in either of which they are arranged.

What is Coal?

A hard, black, sulphurous and inflammable substance, dug out of the earth, serving in many countries as fuel. It is common in most of the countries of Europe. In America it is found in beds extending several thousand miles. English coal is very superior, and forms an article of considerable trade with us, great quantities being exported to France, &c. In the north of England many of the coal mines are of vast extent.

*Sulphurous*, consisting of sulphur. *Inflammable*, burning easily.

From what is coal supposed to have originated?

Its origin is supposed to be derived from gigantic trees which flourished in the swamps and forests of the primeval earth. These having been torn away from their native bed, by storms and inundations, were transported into some adjacent lake, river, or sea.

What next became of them?

They floated on the waters until, saturated with them, they sank to the bottom, and, being buried in the lower soil of adjacent lands, became transformed into a new state among the members of the mineral kingdom. A long interment followed, during which a course of chemical changes, and new combinations of their vegetable elements, converted them to the mineral condition of coal.

*Primeval*, existing before the flood; the earth as it was when first created. *Gigantic*, extremely large, greater than the usual size. *Interment*, burial under the ground. *Elements*, the several parts or principles of which bodies are composed.

What is a Coal Mine?

A subterranean excavation, from which coal is obtained.

Do the terms Coal and Charcoal signify the same substance?

No; charcoal is an artificial fuel, made in imitation of coal, by half burning\* the branches and roots of trees. It is used for various purposes, as the making of gunpowder, polishing brass and copper, &c., and when a clear and bright fire is required, as it burns with little or no smoke; it is dangerous, however, to be shut up many hours in a room with a charcoal fire, as the fumes it throws out are hurtful, and absorb the quantity of air which is necessary to the human lungs.

What then is charcoal?

The coaly residuum of any vegetable burnt in close vessels; but the common charcoal is that prepared from wood, a black, very brittle, light substance, destitute of taste or smell. It is a powerful antiseptic, unalterable and indestructible.

*Residuum*, the remaining part, that which is left. *Antiseptic*, that which prevents putrefaction.

What is Iron?

One of the most useful and universal metals, being

\* See Chapter xii.

found in all mineral earths, and stones, in plants, and animal fluids; it is also the chief cause of the varieties of colour in all of them. Iron is found in great masses, in various states, in the bowels of the earth; it is usually compounded with stone, from which it is separated by the action of fire.

What parts of the world most abound with it?

In the North whole mountains are formed of iron. The most remarkable of any are the Knob Point and Iron Mountain of Missouri, North America.

What are its characteristics?

It is hard, fusible, malleable, of a greyish colour, and seventy-seven times heavier than water; it is the lightest of all metals, as it is also the hardest and most difficult to melt; and the most elastic of all metallic substances, though it becomes red-hot much sooner than any of them. Without iron, society could make no progress in the cultivation of the ground, in mechanical arts, or trades, in architecture or navigation; it is therefore of the greatest use to man.

How long have iron tools been used in European countries?

As long as their histories have existed. This metal appears likewise to have been known and used by the inhabitants of the world in the earliest ages, being frequently mentioned in the Holy Scriptures. In the fourth chapter of Genesis, Tubal-Cain is spoken of as the "instructor of every artificer in brass and iron," and thus their existence was evidently known at that early period of the world.

*Artificer*, one who works or makes. *Fusible*, capable of being melted by fire.

What do you mean by metals?

Useful substances dug from the bowels of the earth sometimes found pure, but mostly mixed with other matter. They are distinguished by their weight, tenacity, hardness, opacity, colour, and brilliancy. The first known metals were gold, silver, lead, copper, iron, and tin, to which was afterwards added platina. The character of metal is, that when exposed to a great heat, it dissolves into parts which are easily moved, or are in actual motion; it bears

the fire without flying off in vapour; and when cold, hardens into a solid mass, and becomes capable of being beaten out by the hammer.

*Tenacity*, the firmness with which one part adheres to another. *Opacity*, want of transparency or clearness. *Decomposed*, separated, unmixed.

What are metals called in their natural state?

Ores, so named because the metal contained in them is either mixed with other metals, or with mineral earths, from which they are separated and purified by various means: such as washing, roasting, &c., but the method is always regulated by the nature of the ore.

What is Copper?

A hard, heavy, ductile metal, found native in the bowels of the earth, and in many ores. After gold and silver, copper is the most malleable and ductile metal; it may be drawn into wires as fine as hair, or beaten into leaves as thin as those of silver. The rust of copper is very poisonous. Copper, mixed with a certain quantity of tin, forms bell-metal.

Where is copper found?

In several parts of England and Wales, particularly in Cornwall, and the Isles of Man and Anglesea. It is an abundant metal, and is found in various other parts of the world. Copper mines have not been worked in England more than two centuries. Native oxides of copper are found in Cornwall, Siberia, and in North and South America.

*Oxide*, a substance combined with Oxygen,\* in a proportion not sufficient to produce acidity.

What are the uses of copper?

They are too various to be enumerated. It is employed to sheathe the bottoms of ships; alloyed with zinc, to make brass; and made into different kinds of vessels and tools for various purposes. Copper coin was the only money used by the Romans till the 485th year of their city, when silver began to be coined. In Sweden, houses are covered with this metal. Copper will not heat or burn so readily as iron.

*Alloyed*, mixed.

What is a Mine?

\* See Chapter xiii., article Oxygen.

A cavity under ground, formed for the purpose of obtaining metals, &c. ; mines are often very deep and extensive. The descent into them is by a pit, called a shaft ; the clues by which mines are discovered, are mineral springs, the discoloration of vegetables, the appearance of pieces of ore, &c.

*Clues*, signs or means by which things hidden are brought to light.

What is Brass ?

A factitious metal, composed of copper, zinc, and lapis calaminaris mixed together. Brass is lighter and harder than pure copper ; melts more easily ; is ductile only while cold, and is less subject to rust ; which properties, together with its beautiful colour and firmness, render it extremely useful in the manufacture of many utensils. Copper and brass melted in equal quantities make bronze, a substance used in sculpture, for the casting of figures and statues.

*Factitious*, made by art, not found in a natural state. *Sculpture*, the art of cutting figures in marble, stone, &c.

What is Zinc ?

A semi-metal of a brilliant bluish white colour. It is a later discovery, and its name even was unknown to the ancient Greeks and Arabians. It is a compound metal, that is, mixed with other substances in the ore, from which it is obtained by smelting in the furnace.

*Semi*, half, not entirely of one substance.

What nation appears to have been longest acquainted with it ?

The Eastern Indians have long known the method of extracting it from the ore, and from them it was brought into Europe.

For what is zinc used ?

From its readiness to dissolve in all acids, and unite with other metals, it is used in alloy with them in the composition of brass, &c. Thin sheets of zinc are also used to cover roofs of houses, and in the manufacture of various household utensils.

What is Lapis Calaminaris ?

Lapis Calaminaris, or calamine stone, is a fossil body of some use in medicine, but chiefly in founding. It is

sometimes brownish, as that found in Germany and England, or red, as that of France. It is dug out of mines, usually in small pieces; generally, out of those of lead. Calamine is mostly found in barren, rocky soils.

*Founding*, the art of casting metals.

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## CHAPTER XI.

**YAMS, MANGOES, BREAD-FRUIT, SHEA OR BUTTER-TREE, COW-TREE, MAIZE, WATER-TREE, LIQUORICE, MANNA, OPIUM, TOBACCO, AND GUM.**

What are Yams?

The roots of a plant growing in most tropical climates. It grows wild in the woods of Ceylon, and on the coast of Malabar. It is supposed to have been brought from the East to the West Indies. The yam is likewise a native of those islands called Polynesia, situated in the bosom of the Southern or Pacific Ocean. The root of the yam is wholesome and well-flavoured: nearly as large as a man's leg, and of an irregular form. Yams are much used for food in those countries where they grow; the natives either roast or boil them, and the white people grind them into flour, of which they make bread and puddings. The yam is of a dirty brown colour outside, but white and mealy within.

What are Mangoes?

The fruit of the mango-tree, a native of India and the south-western parts of Asia: it also grows abundantly in the West Indies and the Brazils. It was introduced into Jamaica in 1782; where it attains the height of thirty or forty feet, with thick and wide-extended branches. The varieties of the mango are very numerous,—upwards of eighty are cultivated; and the quality of these varies according to the countries and situations in which they grow. The mangoes of Asia are said to be much better than those of America.

Describe the appearance of the mango-tree.

The flowers of this tree are small and whitish, formed in pyramidal branches. The fruit has some resemblance

to a short, thick cucumber, about the size of a goose's egg; its taste is delicious and cooling; it has a stone in the centre, like that of a peach. At first this fruit is of a fine green colour, and some varieties continue so, while others change to a fine golden or orange colour. The mango-tree is an evergreen, bearing fruit once or twice a year, from six or seven years old to a hundred.

*Pyramidal*, resembling a pyramid, having the bottom broader, and gradually rising into a point at top.

How is this fruit eaten?

When ripe, it is eaten by the natives either in its natural state or bruised in wine. They are brought into Europe either candied or pickled, as the ripe fruit is very perishable; in the latter case, they are opened with a knife, and the middle filled up with fresh ginger, garlic, mustard and salt, oil, or vinegar. The fruit of the largest variety weighs two pounds or upwards. The several parts of this tree are all applied to some use by the Hindoos: the wood is consecrated to the service of the dead; from the flour of the dried kernels different kinds of food are prepared; the leaves, flowers, and bark are medicinal.

*Medicinal*, fit for medicine, possessing medical properties. *Consecrated*, applied, devoted to one purpose.

Is there not a tree which bears a fruit that may be used for bread?

Yes; the Bread-fruit-tree, originally found in the south-eastern parts of Asia and the islands of the Pacific Ocean, though introduced into the tropical parts of the Western continent and the West India islands. It is one of the most interesting as well as singular productions of the vegetable kingdom, being no less beautiful than it is useful: there are several varieties of the bread-fruit.

Describe its appearance:

This tree is large and shady; its leaves are broad and indented, like those of the fig-tree—from twelve to eighteen inches long, rather fleshy, and of a dark green. The fruit when full grown is from six to nine inches round, and of an oval form—when ripe, of a rich yellow tinge; it generally hangs in clusters of two or three, on a small thick stalk; the pulp is white, partly farinaceous



and partly fibrous, but when ripe, becomes yellow and juicy.

*Indented*, toothed like the edge of a saw. *Farinaceous*, floury, consisting of flour; from *farina*, flour.

How is the bread-fruit eaten?

It is roasted until the outside is of a brown colour and crisp; the pulp has then the consistency of bread, which the taste greatly resembles, and thus it forms a nourishing food; it is also prepared in many different ways, besides that just mentioned. The tree produces three, sometimes four, crops in a year, and continues bearing for fifty years, so that two or three trees are enough for a man's yearly supply.

What are the other uses of this tree?

Its timber, which at first is of a rich yellow, but afterwards assumes the colour of mahogany, is used in the building of houses and canoes; the flowers, when dried, serve as tinder; the sap or juice serves for glue; the inner bark is made by the natives of the South Sea Islands into a cloth for articles of clothing; and the leaves are useful for many purposes. One species of the bread-fruit, called the Jaca-tree, grows chiefly on the mainland of Asia.

*Mainland*, the continent; the greater part.

What is the material difference of the Jaca-tree?

This kind grows to the same if not a larger size than the bread-fruit of the islands, but it is neither so palatable or nutritious; the fruit often weighs thirty pounds, and contains two or three hundred seeds, each four times as large as an almond. December is the time when the fruit ripens; it is then eaten, but not much relished; the seeds are also eaten when roasted. There are also other trees in different parts of the world, mostly of the palm species, which yield bread of a similar kind.

Is there not a tree which produces a substance resembling the butter which we make from the milk of the cow?

The Shea, or Butter-tree, a native of Africa: it is similar in appearance to the American oak, and the fruit, (from the kernel of which the butter is prepared), is something like an olive in form. The kernel is enclosed in a sweet pulp, under a thin, green rind.

How is the butter extracted ?

The kernel, being taken out and dried in the sun, is boiled in water ; by which process a white, firm, and rich-flavoured butter is produced, which will keep for a whole year without salt. The growth and preparation of this commodity is one of the first objects of African industry, and forms a principal article of their trade with one another.

You have given me an account of a useful butter prepared from a plant ; is there not also a tree which can supply the want of a cow ?

In South America there is a tree, the juice of which is a nourishing milk ; it is called the Cow-tree. This tree is very fine ; the leaves are broad, and some of them ten inches long ; the fruit is rather fleshy, and contains one or two nuts or kernels. The milk is very abundant, and is procured by incisions made in the trunk of the tree ; it is tolerably thick, and of a glutinous quality, a pleasant taste, and agreeable smell. The negroes and free people at work on the farms drink it, dipping into it their bread made of maize.

*Glutinous*, having the quality of glue,—an adhesive, gummy substance, prepared from the skins of animals ; it is useful in joining wood, &c., and for many other purposes.

What time of the day is the best for drawing the juice ?

Sunrise ; the blacks and natives then hasten from all quarters with large bowls to receive the milk ; some drink it on the spot, others carry it home to their families.

What is Maize ?

Indian corn. The Indians in New England, and many other colonies in America, had no other vegetable but maize or Indian corn for making their bread. In Italy and Germany there is a species of maize, which forms the food of the poorer class.

Is it larger than our corn ?

The ear of maize yields a very great quantity of grain, having generally eight rows of it, often more, in one ; each row containing thirty grains, and each grain producing more flour than any of our corn ; they are usually of a yellowish, but sometimes of a red, blue, or olive

colour. Though so necessary to the natives, this grain is subject to many accidents.

Why so ?

It does not ripen till September, so that the rains often fall heavily upon it while on the stalk, and the birds peck it while unripe.

Has not Nature provided it with a defence ?

The ear is covered with a thick husk, which keeps off a slight rain, but the birds often eat through it, and devour great quantities of the grain.

For what other purposes do the Indians use this plant ?

The stalks serve as winter food for their cattle ; the husks taken from the ear make a kind of hay ; the Indian women slit these last in pieces, and weave them into baskets, &c.

What island possesses a remarkable substitute for the want of springs of water ?

Ferro, one of the Canary Isles, situated in the Atlantic Ocean. In this island there is no water, except on a part of the beach which is nearly inaccessible ; to supply the place of a fountain, Nature has bestowed on the island a particular kind of tree, unknown in other parts of the world. It is of a moderate size, with straight, long, ever-green leaves ; on its top a small cloud continually rests, which so drenches the leaves with moisture, that it perpetually distils upon the ground a stream of clear water. To these trees, as to perennial springs, the inhabitants of Ferro repair, and are supplied with abundance of water for themselves and cattle.

*Perennial*, lasting through the year, perpetual.

What is Liquorice ?

A plant, the juice of which is squeezed from the roots, and then boiled with sugar. Great quantities of liquorice are exported from Spain, Italy, Flanders, Sicily, &c. The dried root is of great use in medicine, and makes an excellent drink for colds and other affections of the lungs, when boiled with linseed.

What are the Lungs ?

Large spongy substances, which will fill the cavity of the chest in the animal frame, and form the main-spring

of life, fixing part of the air which they draw in, and deriving from it the life and heat of the animal.

What is Manna ?

A sweet, white juice, oozing from the branches and leaves of a kind of ash-tree, growing chiefly in Calabria, the southern parts of Italy and Sicily, during the heats of summer. It is moderately dry, very light, easily crumbled, and of a whitish, or pale yellow colour

Is manna peculiar to the ash-tree of Calabria ?

No ; manna is nothing more than the nutritious juices of the tree which exude during the summer heats ; very hot summers are always those which are most productive of manna ; manna being only produced in warm and dry countries. Several different plants and trees produce a kind of manna ; the best and most used is, however, that of Calabria, in Italy.

*Nutritious, nourishing, wholesome.*

What are its uses ?

It was much esteemed formerly in medicine, but it has now gone nearly into disuse. The peasants of Mount Libanus eat it as others do honey. The Bedouin Arabs consume great quantities, considering it the greatest dainty their country affords. At Mexico, they are said to have a manna which they eat as we do cheese, At Briançon in France, they collect it from all sorts of trees that grow there, and the inhabitants observe, that such summers as produce the greatest quantities of manna are very fatal to the trees, many of them perishing in the winter.

Are there not other trees and plants that produce manna ?

Yes ; the tamarisk, a tree peculiar to Palestine and parts of Arabia ; there is a very abundant sort produced by a thorny plant called camel's thorn, of which there are two species growing in Arabia, Persia, India, and Egypt. On Mount Sinai there is a different species of tamarisk that yields it. It is found on the branches of the tree, and falls on the ground during the heat of the day.

Where is Mount Libanus.

Mount Libanus, or Lebanon, is situated in Asiatic Turkey ; it was anciently famous for its large and beauti-

ful cedar-trees. The "cedars of Lebanon" are frequently mentioned in Holy Writ. There now remain scarcely any of superior size and antiquity, but they vary from the largest size down to mere saplings; and their numbers seem to increase rather than diminish, there being many young trees springing up.

Where is Mexico?

Mexico, the oldest city of North America of which we have any account, is the capital of a large country of the same name.

How is the Italian manna gathered?

In August and September, it is collected by making an incision at the foot of the tree, each day over that of the preceding, about four inches over one another; these cuts, or incisions, are nearly two inches long, and half an inch deep. When the cut is made, the manna directly begins to flow, at first like clear water, but, congealing as it flows, it soon becomes firm: it is then collected in baskets. Manna has been found to consist of two distinct substances; one nearly resembling sugar, the other similar to a gum or mucilage.

*Mucilage*, a slimy mass, a body with just enough of moisture to hold together.

What nation was fed with a kind of manna?

The children of Israel, when wandering in the desert wilderness, where no food was to be procured, were fed by a miraculous supply of manna, showered down from heaven every morning on the ground in such quantities as to afford sufficient food for the whole host.

What is Opium?

A narcotic, gummy, resinous juice, drawn from the head of the white poppy, and afterwards thickened; it is brought over in dark, reddish brown lumps, which, when powdered, become yellow.

*Narcotic*, producing sleep and drowsiness.

In what countries is it cultivated?

In many parts of Asia, India, and even the southern parts of Europe, from whence it is exported into other countries. The Turks and other Eastern nations chew it. With us it is chiefly used in medicine. The juice is obtained by incisions made in the seed-vessels of the

plant; it is collected in earthen pots, and allowed to become sufficiently hard to be formed into roundish masses of about four pounds weight. In Europe the poppy is cultivated mostly for the seeds and the dry pods, which are used in medicine.

What is Tobacco?

An herbaceous plant which flourishes in many temperate climates, particularly in North America; it is supposed to have received its name from Tabaco, a province of New Spain, in that country; it is cultivated in the West Indies, the Levant, the coast of Greece, Archipelago, Malta, Italy, France, Ceylon, &c.

*Herbaceous*, like an herb or plant, not a shrub or tree.

Was it known in Europe before the discovery of America by the Spaniards?

No. It was brought to England about the time of Queen Elizabeth, either by Sir Francis Drake or Sir Walter Raleigh. Tobacco is either taken as snuff, smoked in pipes, or chewed in the mouth like opium. There are many different species of this plant, most of them natives of America, some of the Cape of Good Hope and China; many species are cultivated in Europe.

What part of the plant is used?

The leaves, which are stripped from the plant, and after being moistened with sea or fresh water, twisted up in rolls; these are cut up by the tobacconist, and variously prepared for sale, or reduced into a scented powder called snuff.

Who was Sir Francis Drake?

Sir Francis Drake was one of our most distinguished naval officers, who flourished in the reign of Elizabeth. He was born near Tavistock, in Devonshire, 1545; he made his name immortal by a voyage into the South Seas, through the Straits of Magellan; which at that time no Englishman had ever attempted. He died on board his own ship in the West Indies, 1595.

Who was Sir Walter Raleigh?

Sir Walter Raleigh was an illustrious English navigator and historian, born at Budleigh, in the same county, 1552. He performed great services for Queen Elizabeth, particularly in the discovery of Virginia, in North America,

and in the defeat of the Spanish Armada; he lived in honour and prosperity during her reign; but on the accession of James I., he was stripped of his favour at court, unaccountably accused of high treason, tried, and condemned to die.

What followed?

He received a reprieve, but was imprisoned in the Tower of London for many years, during which time he devoted himself to writing and study. Receiving, at last, a commission to go and explore the gold mines at Guinea, he embarked; but his design having been betrayed to the Spaniards, he was defeated; and on his return to England, in July, 1618, was arrested and beheaded (by order of the king, on his former attainder), in Old Palace Yard, October 29, suffering his fate with great magnanimity.

*High Treason*, an offence committed against the sovereign. *Reprieved*, respited from sentence of death. *Magnanimity*, greatness of mind, bravery.

What is Gum?

A mucilaginous juice, exuding from the bark of certain trees or plants; drawn thence by the warmth of the sun in the form of a glutinous matter; and afterwards by the same cause rendered firm and tenacious. There are many different gums, named after the particular tree or plant from which they are produced.

*Mucilaginous*, consisting of a gum or mucilage. *Tenacious*, adhering closely.

What is the character of gum?

Gum is capable of being dissolved in water, and forming with it a viscid transparent fluid; but not in vinous spirits or oil; it burns in the fire to a black coal, without melting or catching fire; and does not dissolve at boiling heat. Gums are of three kinds: gum resin, a juice partly mucilaginous and partly oily, which flows from many kinds of trees, and becomes hard by exposure to the air; the term gum, therefore, has been improperly given to several resins, to dissolve which requires the addition of spirit, or oil, or both.

What then is gum originally?

A milky liquor, having a greater quantity of water mixed with its oily parts, and for that reason it dissolves

in either water or oil. The third sort is not oily, and therefore dissolves in water only, as gum Arabic, the gum of the cherry-tree, &c.

*Viscid*, thick, ropy. *Vinous*, derived from the French *vin*, wine.

Are the last-mentioned sorts properly called gums?

No, though commonly called gums, they are only dried mucilages, which were nothing else than the mucilaginous lymph issuing from the vessels of the tree, in the same manner as it does from mallows, comfrey, and even from the cucumber; the vessels of which being cut across, yield a lymph which is plainly mucilaginous, and if well dried, at length becomes a kind of gum, or rather, a hardened mucilage.

*Lymph*, transparent fluid.

What is gum Arabic?

The juice of a small tree of the acacia tribe, growing in Egypt, Arabia Petræa, Palestine, and also in different parts of America.

Are there other plants or trees which produce gum, besides those already mentioned?

A great number, though not all commonly in use. The leaves of rhubarb, the common plum, and even the sloe and the laurel, produce a clear tasteless gum; there are also a number of different gums, brought from foreign countries, of great use in medicine and the arts. Most of the acacias produce this gum, though the quality of all is not equally good.

What is Rhubarb?

A valuable root growing in China, Turkey, and Russian Tartary. Quantities of it are imported to other parts of the world: that from Turkey is esteemed the best. Rhubarb is also cultivated in English gardens, and the stalks of the leaves make delicious tarts; but the root, from the difference of climate, does not possess any medicinal virtue.



## CHAPTER XII.

SPECTACLES, MARINER'S COMPASS, BAROMETER, THERMOMETER, WATCHES, CLOCKS, GUNPOWDER, TELESCOPE, MICROSCOPE, STEAM ENGINE, ELECTRO-MAGNETIC TELEGRAPH, AND SUB-MARINE TELEGRAPH.

When were Spectacles invented, and who was their inventor ?

It is supposed that they were first known about the thirteenth century, and invented by a monk of Pisa, in Italy, named Alexander de Spina. Spectacles are composed of two circular pieces of glass set in a frame.

What are these glasses called ?

Lenses. They are either convex or concave, according to the kind of sight requiring them. Old people, and those who can only see things at a distance, from the flatness of the eye, which prevents the rays of light converging so as to meet in the centre, require convex lenses. People who can only distinguish objects when viewed closely, from the eye being too convex, require concave lenses to counteract it by spreading the rays, and thus rendering vision distinct.

*Convex*, rising outwardly in a circular form ; arched, like the heavens ; opposite to concave. *Centre*, the middle or point in any round body. *Concave*, hollow ; round but hollow, as the inner curve of an arch, &c. *Converging*, tending to one point from different parts. *Vision*, the faculty of seeing.

What is the Mariner's Compass ?

A most useful and important instrument, by the aid of which the navigator guides his ship on the sea, and steers it to the place of destination. The inventor of the mariner's compass is not known, nor the exact time of its introduction ; it was employed in Europe for navigation about the middle of the thirteenth century, and has been in use more than five hundred years. The Chinese are said to have been acquainted with it much earlier, but no reliance can be placed on their dates. The power of the loadstone to attract iron was

known to the ancient Egyptians, but not applied to any practical use.

*Navigator*, one who guides a ship. *Steer*, to direct or guide a vessel in its course. *Destination*, the place to which a person is bound. *Practical*, relating to action, not merely in speculation.

### What is the Loadstone ?

An ore which possesses the peculiar property of attracting or drawing iron in contact with its own mass, and holding it firmly attached by its own power of attraction. A piece of loadstone drawn several times along a needle or a small piece of iron converts it into an artificial magnet ; if this magnetised needle is carefully balanced, it will turn round of itself, till its end points towards the north. The magnetised needle also possesses the power of attracting iron, and of communicating this power to another piece of iron or steel, similar to that of the loadstone itself.

*Contact*, touch. *Magnetised*, having the properties of the magnet.

### Describe the mariner's compass.

The mariner's compass consists of a circular box, enclosing a card on which the divisions of North, South, East, and West (called the points of the compass), are printed ; on this is placed a kind of needle, resembling the hand of a clock (with that end which points to the north shaped like the head of an arrow), carefully balanced on a steel point. By simply looking at the position of the needle, the mariner can see the direction in which his vessel is sailing, and regulate his helm accordingly.

*Helm*, the rudder of a ship, by which it is guided through the water.

### What is a Barometer ?

An instrument for measuring the weight of the atmosphere, which enables us to determine the changes of the weather, the height of mountains, &c. It consists of a glass tube, hermetically sealed, a large portion of which is filled with mercury ; according to the weather, if it be dry or wet, this mercury rises or falls.

### What is meant by Hermetically Sealed ?

Closed by heating the edges of a glass vessel till it is just ready to melt, and then twisting them closely together

with hot pincers, by which means the air is totally excluded. The word is taken from *Hermes*, the Greek name for Mercury, the heathen god of arts and learning, and the supposed inventor of chemistry,\* which is sometimes called the hermetical art; or perhaps from *Hermes*, an ancient king of Egypt, who was either its inventor, or excelled in it.

What is Mercury?

Quicksilver, or mercury, is a white fluid metal, the heaviest except platina and gold; it readily combines with nearly all other metals, and is used in the manufacture of looking-glasses, barometers, thermometers, &c.; in some of the arts, and in the preparation of several powerful medicines.

Where is it found?

Mercury is found in many countries, as Hungary, Sweden, and China. It is brought to Europe from the East Indies and Peru; but it is found in greater abundance near Almeria, in Spain, where it is extracted from the ore by distillation. The quicksilver mine of Guanica Velica, in Peru, is one hundred and seventy fathoms in circumference, and four hundred and eighty deep. In this profound abyss are seen streets, squares, and a chapel, where religious worship is performed. The quicksilver mines of Idria, a town of Lower Austria, have continually been wrought for more than three hundred years. The vapour which is continually arising from the mercury is very hurtful to the miners, who seldom survive many years.

*Abyss*, a gulph, a great depth. *Vapour*, smoke, fume.

In what state is mercury usually found?

Either native, or in the form of ore; it is found in Sweden mixed with silver, and frequently combined with sulphur. Running mercury is found in globules, among earth and stones, in America, and is collected from the clefts of the rocks there.

What is the appearance of mercury?

That of melted silver; it is neither ductile nor malleable in this state; it is a substance so volatile when heated that it may be evaporated like water: it is always seen in

\* See Chapter xviii., article Chemistry.

a fluid state, even in temperate climates, as a very small portion of heat is sufficient to preserve it in a state of fluidity. It is used to separate gold and silver from the impure matter found with those metals.

*Globules*, such small particles of matter as are of a circular form.

What is the effect of the combination of mercury with sulphur ?

It forms an ore called cinnabar, the most abundant form in which mercury is found. It sometimes occurs in the shape of crystal, forming a beautiful vermilion.

How is the Vermilion used in the arts prepared ?

By fusing sulphur with six times its weight of mercury, This mixture is called factitious cinnabar, and when reduced to powder, becomes the red pigment called vermilion.

What is a Thermometer ?

An instrument by which is measured the increase or decrease of heat and cold in the air. It consists of a fine glass tube, terminated at one end in a bulb or globe, which is filled either with mercury or some other fluid preparation, usually the first-named : heat or cold acting upon this fluid, causes it to rise or fall according to the different degrees of either. This tube is placed on a frame, on which are marked in figures the degrees, beginning at thirty-two degrees below the freezing point, and ascending at pleasure. The invention of this instrument dates from about the end of the sixteenth century ; but it has not been certainly ascertained who was the inventor or by whom it was first brought into use.

*Terminated*, finished, ended.

When were Watches and Clocks invented, and by whom ?

About the year 1500. The glory of this excellent invention lies between Dr. Hooke and M. Huygens ; the English ascribe it to the former, the Dutch, French, &c., to the latter ; some assert that pocket watches were first brought into England, from Germany, about 1577, having been invented at Nuremberg. Pendulum clocks were invented in 1657.

*Pendulum*, a weight so hung from a fixed point that it may easily swing backward and forward ; of which the great law is, that its motions

are always performed in equal time, provided the length of the pendulum and the gravity remain the same. It is said that Galileo\* was the one who conceived the idea of employing the pendulum in the measurement of time, by observing the regular swinging motion of a lamp suspended from the roof of a church. *Gravity*, the weight or heaviness of a body, which inclines it towards the ground.

To whom is the invention of Gunpowder ascribed ?

Most authors suppose it was invented by Bartholdus Schwartz, a monk of Goslar, a town of Brunswick, in Germany, about 1320 ; others maintain that it was known much earlier in many parts of the world, and that our famous Roger Bacon knew its properties nearly a hundred years before Schwartz was born.

Who was Roger Bacon ?

A learned monk, born at Ilchester, in Somersetshire, in 1214. He was the miracle of the age in which he lived ; but such was the ignorance of those distant times, that his great talents and the astonishing progress he had made in the sciences, were regarded by his brother monks and the people at large as the consequences of magic ; they even went so far as to forbid him to read lectures, and imprisoned him in a cell for ten years ; he, however, was at last set at liberty, spent the remainder of his life in peace, and died at Oxford, in 1294, aged eighty years. To him we owe the invention of the telescope ; that of gunpowder is ascribed to him, as is also the introduction of chemistry into Europe.

What is understood by Magic ?

Magic is a term used to signify an unlawful and wicked kind of science, depending, as was pretended, on the assistance of devils and departed souls. The term was anciently applied to all kinds of learning, and in particular to the science of the Magi or wise men of Persia, from whom it was called magic.

What do we at the present time understand by magic ?

That which teaches the art of performing wonderful or surprising effects. There is, also, *natural* magic, which is no more than the application of natural active causes to passive things or subjects, by means of which many surprising, yet *natural*, effects are produced.

\* See page 92.

Of what is gunpowder composed ?

Of saltpetre,\* sulphur, and charcoal, mixed together and powdered ; this mixture easily takes fire, and when fired, expands with great vehemence, by means of its elastic force ; it takes its name from the instrument called a gun, in which it is generally placed to be fired off ; it is used in war, field sports, &c. ; to make it more destructive, metal balls of different sizes, such as cannon balls, shot, &c., are placed with it, which, when the gun or cannon is fired, are thrown to a great distance, and are mostly fatal to those bodies which they strike.

Is not gunpowder highly combustible ?

So combustible is gunpowder, that a single spark of fire lighting upon any of it will cause it to explode with immense force ; and instances have occurred, when any store or magazine of it has taken fire, that have been attended with the most fatal effects. It is useful to the miner and engineer as a ready means of overcoming the obstacles which are presented in their search for mineral treasures, and in procuring materials for building.

*Engineer*, one who works or directs an engine. *Obstacles*, difficulties, opposition. .

Was there not a similar composition known to the ancients ?

From many passages in ancient authors there is reason to suppose that gunpowder, or a composition extremely like it, was known to them ; but whatever knowledge of gunpowder was possessed by the ancients, it does not appear to have been in general use, and the invention of fire-arms is comparatively modern.

What is Saltpetre ?

A bitter kind of salt called by the ancients nitre, but more commonly among us saltpetre. It is composed of nitric acid and potass.† It is found in imperceptible particles, in earthy substances ; sometimes native or pure, in the form of a shapeless salt. A nitre is also obtained from several plants. Vast quantities are found in several of the marly earths of the East Indies, China, Persia, and

\* See Chapter xiii.

† See Potash, Chapter vii., article Glass.

other parts of the East. In India nitre is found naturally crystallised.

*Nitric*, having the quality of nitre, one of the parts which compose saltpetre. *Imperceptible*, not seen.

What do you mean by Marly ?

Consisting of marl, a kind of earth composed of different proportions of clay and chalk ; it is not the least ductile or viscid when moist, and easily dissolves in water. There are marls of several colours, each possessing different qualities. The most common are the red and white, though there are ash, grey, brown, blue, and yellow-coloured marls.

In what reign was a conspiracy formed to blow up the Parliament-house, together with the King, Lords, and Commons, with gunpowder ?

In the reign of James the First. This wicked design to destroy the king, with a great number of his illustrious subjects then assembled, was ascribed to the Papists ; the plot being discovered, barrels of gunpowder were found in a cellar beneath the Parliament-house, concealed under faggots of wood. The principal conspirators were Winter, Catesby, and Fawkes, which last undertook to set fire to the train ; but this diabolical attempt was happily discovered, and Fawkes taken prisoner on the spot, the evening before it was to have happened.

*Conspirators*, persons united to commit a crime. *Diabolical*, wicked, devilish ; partaking of the qualities of the devil.

What is a Telescope ?

An optical instrument, which serves for discovering and viewing distant objects, either directly by glasses, or by reflection. The invention of the telescope is one of the noblest and most useful that modern ages have to boast of, since by means of this instrument the wonderful motions of the stars, and all the bodies of the heavens, are discovered. The honour of the invention is much disputed ; it is certain, however, that the celebrated Galileo was the first who improved the telescope so as to answer astronomical purposes. Telescope is formed from two Greek words, one signifying far, the other to observe.

*Optical*, relating to optics, the science of vision, or to an instrument or organ of sight. *Astronomical*, relating to astronomy.

### Who was Galileo ?

A most eminent astronomer and mathematician, born at Florence, in Italy. His useful inventions and discoveries in astronomy, geometry, and mechanics, greatly forwarded the progress of those sciences. Galileo died in 1642.

*Astronomer*, one who studies astronomy. *Mathematician*, one who studies mathematics—a science which contemplates whatever is capable of being numbered or measured.

### What is Astronomy ? \*

That science which treats of the heavenly bodies, their motions, periods, eclipses, magnitudes, the laws which regulate their motions, and the causes on which they depend.

*Eclipse*, one body overshadowing another, or totally or partially obscuring it. *Magnitude*, greatness, dimension.

### What is Geometry ?

An ancient, perfect, and beautiful science, which enables us to determine the relations and proportions of objects, or figures.

### What is meant by Mechanics ?

The science which investigates the laws of forces and powers of bodies in motion and combination, and shows their action on them either directly or by machinery. When the term *mechanic* is applied to a *person*, it means one skilled in mechanics, used to manual labour.

*Investigate*, to search, to inquire into. *Manual*, performed by the hand.

### What is a Microscope ?

An optical instrument, by means of which very minute objects are represented exceedingly large, and viewed very distinctly according to the laws of refraction or reflection. Nothing certain is known respecting the inventor of microscopes, or the exact time of their invention, but that they were first used in Germany about 1621.

*Minute*, small, diminutive. *Refraction*, a change of determination in the body moved, which happens to it whilst it enters any centre. *Reflection*, the act of throwing back light.

### What is the Steam Engine ?

A machine that derives its moving power from the force of the steam produced by boiling water, which is

\* See Chapter xviii.



very great, especially when, as in the steam engine, it is confined within a certain compass: this useful engine is one of the most valuable presents that the arts of life have received from the philosopher, and is of the greatest importance in the working of mines; supplying cities with water; in working metals; in many mechanical arts; and in manufactories.

What else is accomplished by the aid of steam?

Vessels\* are enabled to sail over the seas with greater swiftness than those which are wholly dependent on the winds and tides; and thus trade is spread abroad, and we are enabled to communicate with distant lands in a much shorter space of time than was formerly consumed. On land, railroads are constructed, on which steam carriages will convey its inhabitants to places many miles distant from each other with astonishing quickness, so that a journey which by coach and horses would take two or more days, may be performed in a few hours or a day by the aid of steam.

*Mechanical*, belonging to mechanics.

To whom are we indebted for its invention?

The steam engine was invented by the Marquis of Worcester, in the reign of Charles II.; but it does not appear that the noble inventor could ever interest the public in favour of this, or his other discoveries. Since that period it has been successively improved by various persons; but it is to Mr. Watt, of Glasgow, and Mr. Boulton, of Soho, near Birmingham, that it is indebted for much of its present state of perfection.

What is a Railway?

A road or way composed of smooth tracks of iron, wood, &c., to facilitate the motion of wheel carriages. They are of various kinds, and were first adopted in the seventeenth century, in order to reduce the labour of drawing coal, &c., from the pits to the places of shipment. These were called tramroads. The application of the steam engine to railways was first suggested by Watt.

Was this suggestion carried out?

It does not appear to have been attended to till 1802,

\* See Chapter xvii., article Navigation.

when Trevithick and Vivian, engineers, constructed a superior engine, which, notwithstanding its simplicity, possessed all the most important arrangements of the modern engines. In fact, the ideas of its inventors were so complete, that subsequent engineers have only had to improve and carry out their suggestions.

When were railways generally adopted as modes of public conveyance?

The Surrey Iron Railway, in 1801, was the first in England, since which time they have so increased as almost entirely to do away with the old method of coach-travelling. The first American railway opened in 1837. In France, a line of twelve miles was first completed in 1828. In Germany, one of 130 in 1829; and in Russia, one from St. Petersburg to the distance of seventeen miles in 1837.

Which was the first English railway for passengers?

The Liverpool and Manchester line, opened in October, 1824.

How is a railway, which requires a level surface, carried along the *uneven* land?

Tunnels or hollow ways are cut through hills; embankments are thrown up on low lands; and bridges built over rivers, roads, or streets.

How are the tunnels supported?

The tunnels, which are arched, are supported by brick and ironwork. The bridges or elevated roadways thrown across low lands, &c., are called *viaducts*.

What other important invention has lately been added to the railway system?

The Electric Telegraph. By means of this instrument intelligence is conveyed to any distance with the rapidity of lightning. The electric fluid, when an excess has collected in one place, always seeks to transfer itself to another, until an equal distribution is restored. If two distant places are connected by a metal wire, called the telegraphic wire, the fluid instantly traverses its whole extent, and charges the electro-magnet at the distant station. This fluid is produced at pleasure by an electrical machine called a galvanic battery, and made to pass along the wire.

What follows ?

At the station is an instrument having a dial with two *vertical* index-needles, suspended side by side, on separate centres. On these centres, behind the face of the dial, are two magnetic needles, surrounded by coils of very fine copper wire, encircled with silk. At the bottom of the instrument are two handles, connected with an apparatus which causes the electricity to pass through the wire coils and affect the magnetic needles.

What is the use of these handles ?

By them the needles are turned right or left, at the will of the person who moves the handles. The wire coils are connected by the wires running along the railway with the coils of like instruments at distant places, so that on moving the handles of either instrument, the needles of both are simultaneously moved. Different inventors have, however, their various methods of arranging the machinery, all possessing different degrees of merit

How are these wires extended from place to place ?

They are supported on posts along the sides of the railway. In London the wires are enclosed in a non-conductor,\* and buried in pipes under the roads or pavement. Gutta Percha† is now found to be the best coating both for underground and submarine telegraphs.

What method is employed to make the communications understood ?

By the movement of the needles, a series of signs are made to represent the letters of the alphabet, and a person employed for the purpose easily reads the message which is conveyed, and arranges an answer by the same method.

To whom are we indebted for this invention ?

Mr. Cook first practically introduced and carried it out, while Professor Wheatstone is acknowledged as the scientific man whose profound and successful researches enabled the former to make it capable of application to a work of national importance. Their telegraph was brought out in 1837. Electric telegraphs are now in operation between nearly all the important cities of Europe and the United States.

\* See Electricity, page 6. † Gutta Percha, page 105.

What is the meaning of electro-magnet?

A magnetic\* compass or needle, charged with an electric current, which invests it with the property of inclining towards a fixed point. The great discovery of electro-magnetism was first made in 1819, by Professor Oersted.

Is there not another machine connected with the telegraph?

Yes, the printing-machine, by means of which the messages conveyed by the telegraph are printed. The machinery is propelled chiefly by the power of weights or clock springs, and the whole motion is regulated by the electric current.

What is the Submarine Telegraph?

A similar apparatus, by which communications can be transmitted under the sea to foreign shores.

Where is there one in use?

Between England and France, from the towns of Dover and Boulogne. The pipes of the submarine telegraph require to be very carefully enclosed in a tubing of gutta percha and protected with iron pipes, or bound with galvanised iron wire, outside which is another coating of gutta percha.

*Galvanised*, affected with galvanism, an electrical phenomena, in which the electricity is developed without friction, and in which chemical action takes place between certain bodies. Its name is from Galvani, the discoverer, a native of Bologna.

What bodies are used in Galvanism?

Galvanism, or galvanic electricity, is produced by two dissimilar solids, usually metals, connected in a liquid which dissolves only one. The more unlike they are, the greater the quantity and power of the electricity produced. It is sometimes called Voltaic, from an Italian named Volta, who made additional discoveries in it.

How is it produced?

By an apparatus, called a battery, or trough, consisting of plates of zinc and copper, &c., fastened together in a wooden or earthenware trough, so as to form a number of cells. The trough is then filled with diluted acid, as sulphuric, nitric, &c., whichever liquid can furnish oxygen

\* See Magnet or Loadstone, page 86.

to the metal that will most readily dissolve. These cells are then connected by a band of metal dipped into it.

What are the uses of galvanism?

For chemical purposes in the decomposition of bodies, &c.; in working metals; casting medals or coins; the conveyance of the electric fluid by conductors and magnets; in physic and other arts.

What is the signification of *Telegraph*?

*To describe at a distance*, from two Greek words, for distant and write. Telegraphs are machines contrived for communicating intelligence to a distance by means of a set of signals representing words, letters, or signs—simple, yet easily understood. They were used for communication from the ports with vessels at sea, or to convey speedy news in time of war.

Are they a modern invention?

The first practical telegraph was that of Dr. Hooke in 1684, who was also the inventor of several other ingenious mathematical instruments. His method was successively improved on till it was brought to a state of high perfection. The electric telegraph is the latest and most wonderful, and supersedes them all.

What were used before telegraphs?

The idea of communicating by signs occurred even to uncivilised man. The North American Indians convey signals from hill to hill by throwing about their arms, holding up skins, or spreading out their cloaks: the Hottentots and others light fires on the sides of hills. The use of fire-signals for giving speedy warning of the approach of an enemy is dated from the most remote antiquity.

Namesome instances.

The prophet Jeremiah, in his sixth chapter, says, "Set up a *sign of fire* in Beth-haccerem; for evil appeareth," &c. A line of fire signals or beacons communicated the fall of Troy. Amongst the Scotch this custom was constantly practised, as well as by many other nations, both in the north and east.

## CHAPTER XIII.

SOAP, CANDLES, TALLOW-TREE, SPERMACETI, WAX, OILS, MAHOGANY, INDIAN RUBBER OR CAOUTCHOUC, GUTTA PERCHA, SPONGE, CORAL, LIME, CARBON, OXYGEN, NITROGEN, OZONE, CALORIC, GAS, HYDROGEN, CHALK, AND MARBLE.

Of what is Soap composed ?

Of a kind of paste, sometimes hard and dry, sometimes soft and liquid, made from ley boiled up with tallow and oil ; these are the ingredients used for making soft soap ; in hard soap, the oil is omitted, and it is made with the ley of wood-ashes and tallow ; the finest soaps are made with olive oil, and the alkaline salt, called soda or barilla. Also from palm-tree oil, cocoa-nut oil, and others.

What are soaps often mixed with besides ?

With essences, oils, &c., for beautifying and cleansing the skin, as honey, almond, and other soaps ; and for medicinal effects with different substances, as sulphur-soap, tar-soap, glycerine,\* &c.

When was the manufacture of soap first begun in London ?

In 1524, before which we were supplied with white soaps from foreign countries, and with the common grey or speckled from Bristol. The ancient Greeks and Hebrews appear to have been acquainted with the art of making soap, or a composition very similar to it ; and also the ancient Gauls and Germans. A soap-boiler's shop, with soap in it, was found in the city of Pompeii, in Italy, which was overwhelmed by an eruption of Mount Vesuvius, A.D. 79.

What is Soda ?

Soda, or barilla, is a preparation from the ashes of plants, particularly those of the plant kali before mentioned in the subject of glass ; though generally procured from plants, its great depository is the ocean, soda being the basis of sea salt. Soda, combined with acids, is found mixed with earth in Hungary, Bohemia, and Switzerland ; also in China, Syria, Persia, and India.

From what is the soda obtained ?

\* See Chapter viii., article Oil.

From maritime plants, which are endowed with the property of decomposing the sea salt which they imbibe, and by some process of vegetation, separating and absorbing the soda from the other parts. Soda is also procured by chemical process from sea salt itself. Soda is found native in Egypt, and is there called *natron*, a name similar to that which it bore among the Jews and Greeks.

*Depository*, storehouse, a place where anything is lodged. *Imbibe*, to suck in. *Absorbing*, the act of imbibing or sucking up. *Basis*, the foundation of anything. *Maritime*, belonging to the sea coast.

Is there not a soda called Carbonate?

Carbonate of soda, also obtained from kelp and barilla, plants cultivated for the purpose on the shores of the Levant. In England, it is chiefly manufactured from common salt,\* by the agency of oil of vitriol.† Kelp is the melted ashes of burnt seaweed, and is manufactured on the western shores of Ireland and Scotland.

*Carbonate*, a compound of carbonic acid, with a salt.‡ *Sulphate*, sulphuric acid combined with another body.

What are the uses of carbonate of soda?

It is one of the most important of chemical substances, from its consumption in the arts, in washing, baking, medicine, &c.

Of what are Candles made?

Of tallow, which means animal fat melted, and cleansed from filth. Tallow is procured from many animals; the most used, is that made from oxen, sheep, swine, goats, deer, horses, bears, and vipers; some of which tallows or fats are used in medicine, some in making soap, and dressing leather; others in the manufacture of candles, &c.; for the last mentioned article, that of sheep and oxen is most used.

Is tallow the only material employed?

Candles are made of wax, spermaceti, cocoa-nut fat, &c., of fat acid, known as stearic candles; || and of a mixture of stearic acid and neutral fat, known as composite candles. All these have different degrees of illumination, those

\* See Chapter ix., article Salt.

† See Carbon, p. 110.

‡ Ditto, article Vitriol.

§ See Chapter xiv., article Sulphur.

|| See Chapter viii., article Glycerine.

made of the fat acids giving a greater flame than the others.

How so?

Because in all tallows and oils there is a body which reduces the illuminating power of candle material. This body is called glycerine.\* The difficulty of separating this from the more valuable material for candles, called for the aid of science.

What effect has this produced?

It has raised candle-making from a simple, clumsy, offensive trade, into a chemical manufacture, offering a wide field for the application of the highest chemical art.

Who first applied science to this branch of industry?

Chevreuil, the great French chemist, in 1811. In 1825 he and Gay-Lussac applied their studies to practical use, and the first successful stearic candles appeared in Paris in 1833; but nothing was put in practice by the French chemists and manufacturers till 1846 or 7. Their process, however, was adopted in England by "Price's Patent Candle Company," who produced the beautiful stearic, sperm,† composite, and other candles of the present day, which are used all over the world.

What is meant by neutral?

Neutral means neither of two, and expresses that effect which takes place when two bodies combined destroy or neutralise the properties of both. Thus two kinds of fat alter the qualities of each other.

How are candles kept alight?

By means of a wick of cotton or rush placed in the centre of the tallow, wax, &c. The present wicks are cotton threads plaited together; those not requiring snuffing have a little metallic wire in the centre, which keeps the end short.

How are the candles formed?

Formerly by dipping the wick in the melted fat. They are now made in moulds or frames, with the wick in the centre. The use of moulds was not adopted till long after the fifteenth century.

About what date are candles mentioned in history?

\* See Chapter viii., article Oil.

† See Chapter viii., Spermaceti.



In Roman history they are spoken of as far back as 700 years B.C. Some old books which had been lost, were found many years after by a scribe, "bound every way with candles," made of string.

What were the first candles ?

Fats rubbed over porous substances, as the leaves of the papyrus covered with wax or tallow ; the peel or rind of the flax plant ; then string dipped into pitch, wax, or grease, the forerunner of the modern wick. The pith of the rush is yet in use for the commonest sort.

Is there not a tree which yields a vegetable tallow ?

The Chinese have a tree producing a substance like tallow, of which they make candles. It is extracted from the stone of the fruit, the tallow being a white pulp surrounding it.

*Extracted, drawn from.*

Is this the only instance ?

The varieties seem endless, as discovery advances. There is the tallow-tree of Borneo, the Lumbaug-nut and Bassia-butter of central India, the tree or insect-wax of China, and a species of myrtle shrub in America, growing on the temperate coasts, having seeds that yield a wax used for the same purpose. Many of these are imported, and in general use for lamp oils and candle-making. Their products are mostly obtained by crushing-machines, or by boiling.

What is Spermaceti ?

A whitish, flaky, unctuous substance, prepared from an oily substance contained in the cavities of the head of the sperm whale. This species is distinguished from the common whale by having teeth, and a hunch on its back.

*Flaky, having the nature of flakes.*

What is Wax ?

A soft, yellow, concrete matter, collected from vegetables by the bee, of which this industrious and useful insect constructs its cell. Wax forms a considerable article of trade ; it is of two kinds, the yellow and the white ; the yellow is the native wax as it is taken from the hive, and the white is the same washed, purified, and exposed to the air.

*Concrete, grown together, solid.*

How ancient is the use of artificial light ?

Almost as ancient as that of kindling a fire for warmth, of which we have account in Scripture. Watching the fire, man soon observed some woods to burn with great brilliancy, and that it was the oil or resin dropping from them which was the cause. In cooking he found animal fat produced a rapid and bright flame. Hence the origin of torches, flambeaux, and tapers ; then of lamps and candles.

Which would be the most ancient ?

Probably lamps. These at first were made of burnt clay, containing oil or fat in their hollow. As civilisation advanced, their materials became various, and their forms elegant and highly ornamental. Their light, however, was indifferent, the principle of combustion, and the nature of the atmosphere not being understood.

How is it with modern lamps ?

They are constructed so as to surpass candles in brilliancy, and so formed that the atmospheric air and combustion are made to maintain their exact proportions. M. Argand, of Geneva, invented one of the first improvements ; and there are many on similar principles. The glass globes and shades with which the flame is now covered, soften and throw out the light, while they keep it steadily burning.\*

What oils are burnt in lamps ?

Those obtained from whale-fat, seals, cod-fish, and others : the most general in present use, are those from the oily nuts and seeds of trees and plants ; and volatile oils or essences† from the woods of trees, as camphine, from the pine and larch ; palm‡ and cocoa-nut oil ; naphtha,§ from coal-tar produced in gas making ; petroline, paraffin, and other mineral oils or oily spirits. Peat, when distilled, also yields a bituminous liquid, which gives a brilliant flame.

*Peat*, moss or turf found on bogs.

What is Petroline ?

An oily liquid distilled from pit-coal with water, which resembles the mineral oils of the springs.

\* See Chapter xiii., Gas, Hydrogen, &c.

† Chapter viii., article Oils. ‡ Chapter viii., article Palm-tree.

§ Chapter viii., article Naphtha.

### What is Paraffin?

A liquid not unlike petroline, distilled from the products of the asphaltum mines at Havanna in Cuba, and Porto Rico, in the West Indies. Asphaltum, like naphtha, is a native bitumen; but while the last named is a whitish, transparent fluid, asphaltum is in a pitchy or hardened state. It is found floating on the surface of the Dead Sea, or Lake Asphaltites; hence the name; also on the Pitch Lake, in the Isle of Trinidad.

### You spoke of Oil-springs.

These are oily, bituminous fluids, which issue from rocks, or underground springs, as petroleum, which means rock-oil; it is also called Barbadoes tar, being found in those islands. There are springs of it at Modena and Parma in Italy; and it distils from coal-beds in England, Germany, &c. There are similar oil-springs in Pennsylvania, North America. All these are of more or less utility in the arts, or for purposes of illumination.

*Illumination*, a lighting up.

### What is Sealing-wax?

A composition for sealing letters, despatches, &c., erroneously called wax, there being in it not a particle of true wax. It is made of a kind of gum, called lacca, prepared with resins, and coloured with pigments. Red sealing-wax consists of two parts of shell-lac, one part of resin and one of powdered vermilion mixed and melted over the fire; when thoroughly mixed it is worked into sticks, by rolling it on a copper plate or stone, with a tin or copper roller.

### How is the polish obtained?

By turning them in a machine for the purpose over a clear fire, till the outside melts.

### What tree produces the beautiful and well-known wood so much used in making the various articles of household furniture?

The Mahogany-tree, growing in America, the East and West Indies; it frequently grows in the crevices of rocks, and other places of the same description. The introduction of this wood into England took place at the end of the seventeenth century.

Relate the manner in which its value was discovered.

The captain of a West India ship, on his return to England, having on board several logs of mahogany for the purpose of ballast, made his brother, who was a London physician, a present of the wood, he being engaged in a building project; his carpenter, however, threw it aside, observing that it was too hard to be worked. Some time after, his wife being in want of a box to hold candles, the cabinet-maker was directed to make it of this wood; he also made the same objection, and declared that it spoilt his tools. After another trial, he at length succeeded; and when the box was polished, the beautiful colour of the wood was so novel, that it became an object of great curiosity. Before this time, mahogany had been used partially in the West Indies for ship building, but this new discovery of its beauty soon brought it into general use for the making of furniture.

*Crevice*, a rent, a crack. *Ballast*, weights used in a vessel to balance it and keep it steady.

#### What is Indian Rubber or Caoutchouc?

An elastic, resinous substance, procured from a tree, growing abundantly at Cayenne, Quito, and other parts of South America; and also in some parts of the Indies. The tree which produces it is large and straight, about sixty feet high. There is, however, a smaller species, about the size of large shrubs, found in some of the Indian Islands, Sumatra and Java.

#### How is the caoutchouc prepared?

The manner in which they obtain this juice is by making cuts in the bark of the tree, from which the fluid resin issues in great abundance, appearing of a milky whiteness as it flows into the vessel placed to receive it, but gradually becoming of a dark reddish colour on exposure to the air, and soft and elastic to the touch.

#### To what use is this substance put?

The Indians make of it boots, shoes, bottles, flambeaux, and a species of cloth which they use for the same purposes as we do oil-cloth. Amongst us it is employed in making cloth for repelling the rain, shoes, elastic web-bings, and many other articles.

*Flambeaux*, torches burnt to give light.

How do they preserve it from the action of the atmosphere?

Heat rendering it sticky and inapplicable to many purposes, experiments were made to mix it with some substance that would prevent the action of the atmosphere upon it. An American gentleman, Mr. Goodyear, discovered that sulphur would do this. The process is called vulcanisation.

*Vulcanisation*, from to vulcanise, a term possibly derived from volcanoes, now volcanoes, sulphur being always present in or near them.

What has been the effect?

It has rendered this substance available for the manufacture of tubing, globes, and a prodigious number of articles. Caoutchouc, mixed with gum-lac and naphtha, is converted into what is called *marine glue*; it is used for fastening the seams of vessels, and for cementing glass, metals, &c.; in the manufacture of philosophical, chemical, and other instruments.

How long has caoutchouc been discovered?

It was known to the Spaniards, in Mexico, as far back as 1576, who learned its use from the Indians. In 1743 a French traveller in South America investigated its properties, and imported the gum into France in a fluid state. It was long known before its character was sufficiently understood to make it so useful as it now is.

What is Gutta Percha?

An oily resin resembling caoutchouc, discovered at Singapore, an island off the south coast of Malacca, in 1842. The tree from which it is extracted grows also in Borneo and the Malay peninsular. The natives use it for knife handles, &c., in preference to wood or bone.

How is it imported?

In thin layers, and soft jelly-like state. In 1845, large manufactories of it were established at Stratford, near London, where it is made into articles of every description, as bands for machinery, boot and shoe soles, harness, flutes, picture-frames, surgical instruments, and numberless articles for ornament and use. It is of a firmer nature than India-rubber, while its elasticity is scarcely inferior; and it can be prepared into a sheet not thicker than paper, or worked into the consistence of stone or wood.

What is sponge ?

A marine substance, found adhering to rocks and shells, under the sea-water, or on the sides of rocks near the shore. Sponge was formerly imagined by some naturalists to be a vegetable production ; by others a mineral, or a collection of sea-mud, but it has been since discovered to be the fabric and habitation of a species of worm, or polypus.

*Naturalists*, those who study nature, whether animal, vegetable, or mineral.

What do you mean by Polypus ?

A species of animals, called zoophytes, by which are meant substances between animal and vegetable ; animal in substance, possessed indeed of a stomach, but without the other animal characteristics of blood-vessels, bones, or organs of sense,—the animal and vegetable running into each other imperceptibly : these creatures live chiefly in water, and are mostly incapable of motion ; they increase by buds or excrescences from the parent zoophyte, and if cut off will grow again and multiply, each part becoming a perfect animal. Myriads of the different species of zoophytes reside in small cells of coral, sponge, &c., or in forms like plants ; and multiply in such numbers as to create rocks and whole islands in many seas by their untiring industry. Polypus signifies having many feet, or roots ; it is derived from the Greek.

*Imperceptibly*, without being seen or perceived. *Myriads*, countless numbers.

From whence are the best and greatest number of sponges brought ?

From the Mediterranean, especially from Nicaria, an island near the coast of Asia, and others : the collection of sponge forms, in some of these islands, the principal support of the inhabitants. They are procured by diving under water, an exercise in which both men, women, and children are skilled from their earliest years. The fine small sponges are esteemed the best, and usually come from Constantinople ; the larger and coarser sorts are brought from Tunis and Algiers, on the coast of Africa. Sponge is very useful in the arts as well as for domestic purposes.

What is Coral ?

A substance which, like sponge, was considered as a vegetable production, until about the year 1720, when a French gentleman of Marseilles commenced (and continued for thirty years) a series of observations, and ascertained that the coral was a living animal of the polypus tribe. The general name of zoophytes, or plant animals, has since been applied to them. These animals are furnished with minute glands, secreting a milky juice, which, when exuded from the animal, becomes fixed and hard. The different species of coral are almost numberless, and all equally curious and beautiful.

*Series*, a course, or regular number. *Glands*, vessels. *Exuded*, from exude, to flow out.

Is this substance considered by naturalists as the habitation of the insect?

Not merely as the habitation, but as a part of the animal itself, in the same manner that the shell of a snail or an oyster is of those animals, and without which they cannot long exist. By means of this juice or secretion, the coral insects, at a vast but unknown depth below the surface of the sea, attach themselves to the points and ridges of rocks which form the bottom of the ocean; upon which foundation the little architects labour, building up, by the aid of the above-mentioned secretion, pile upon pile of their rocky habitations, until at length the work rises above the sea, and is continued to such a height as to leave it almost dry, when the insects leave building on that part, and begin afresh in another direction under the water. Huge masses of rocky substances are thus raised by this wonderful little insect, capable of resisting the tremendous power of the ocean when agitated to the highest pitch by winds or tempests.

*Architect*, one who builds.

How do these coral rocks become islands?

After the formation of this solid, rocky base, sea-shells, fragments of coral, and sea-sand, thrown up by each returning tide, are broken and mixed together by the action of the waves; these, in time, become a sort of stone, and thus raise the surface up higher and higher; meanwhile the ever-active surf continues to throw up the shells of marine animals and other substances, which fill

up the crevices betwixt the stones ; the undisturbed sand on its surface offers to the seeds of trees and plants cast upon it by the waves, a soil upon which they rapidly grow, and overshadow the dazzling whiteness of the new-formed land.

*Surf*, the white spray or froth of the sea waves.

What follows ?

Trunks of trees, washed into the sea by the rivers from other countries and islands, here find a resting place, and with these come some small animals, chiefly of the lizard and insect tribe. Even before the trees form a wood, the sea-birds nestle among their branches, and the stray land-bird soon takes refuge in the bushes. At last, man arrives and builds his hut upon the fruitful soil formed by the corruption of the vegetation, and calls himself lord and master of this new creation.

Where is the coral insect most abundant ?

It is found in most great seas ; it also is particularly abundant in the Mediterranean, where it produces coral-lines of the most beautiful forms and colours : but it is in the Pacific Ocean where these tiny workmen are effecting those mighty changes, which exceed the most wonderful works of man.

What is that part of the Pacific called, where the coral rocks are most abundant ?

The Coral Sea, from the great number of coral reefs and sunken islands, with which it abounds ; it includes a region of many hundred miles in extent, the whole of which is studded with numberless reefs, rocks, islands, and columns of coral, continually joining and advancing towards each other. All navigators who have visited these seas state, that no charts or maps are of any service after a few years, owing to the number of fresh rocks and reefs which are continually rising to the surface. Such is the wonderful instinct of these animals, to continue working without ceasing, until their labours are finished or their lives extinct.

*Reef*, a chain or line of rocks lying near the surface of the water.

*Extinct*, at an end, dead.

What are the names of the principal islands of coral formation ?



The New Hebrides, the Friendly Isles, the Navigation Isles, the Society Islands, the Marquesas, the Gambier group, and others. These groups are separated from each other by channels or seas, wider than those which divide the individual islands which form the respective groups; but all these waters abound with shoals and minor islets, which point out the existence of a common base, and show that the work by which they will afterwards be united above the level of the sea is constantly going forward.

*Shoals*, crowds, numbers near together. *Minor*, lesser, smaller than others. *Existence*, presence, being.

What is a singular characteristic of the Coral Islands?

On all of them a plentiful supply of sweet and fresh water may be obtained by digging three or four feet into the coral; and even within one yard of high-water mark such a supply is to be found. They are mostly covered with a rich, deep soil, and well wooded with trees and evergreens of different kinds. These islands vary in extent, as well as in the degree of finish to which they have arrived; some of the largest being about thirty miles in diameter, and the smallest something less than a mile;—all of various shapes, and all formed of living coral.

*Diameter*, size across, width.

Is coral put to any use by man?

White coral, which is nowhere so abundant as about the shores of Ceylon, and others of the neighbouring Indian coasts, is employed as lime by the inhabitants of all that part of the world, for building houses, &c., by burning it after the manner of our lime. This coral lies in vast banks, which are uncovered at low water. Coral, particularly the beautiful red sort, is likewise made into various ornaments, as necklaces, &c.

Of what is our Lime composed?

Of a useful earth, which absorbs moisture and carbonic acid, and exists as limestone, or in marble and chalk, which when burnt becomes lime: in its native state it is called carbonate of lime, and is burnt to disengage the carbonic acid; when made into a paste, with one part water and three parts lime,\* and mixed with some other

\* See Chapter xvi., article Lime.

minerals or metallic substances, it forms plastic cements and mortars; and afterwards, imbibing carbonic acid from the atmosphere, it becomes again carbonate of lime, as hard as at first; and hence its use in building.

*Plastic*, yielding, capable of being spread out when first made, but afterwards becoming hard and firm.

What do you mean by Carbon?

A simple substance, whose most common form is purified charcoal: it is, in fact, the base of charcoal, divested of all impurities, but which, combined with oxygen, forms *carbonic acid* gas, or fixed air. Charcoal (the origin of which has been explained in a former chapter) is in itself not gas, though it appears to serve as a general fixer of gases. Carbon, or pure charcoal, is that hard substance which is diffused through all animal and vegetable bodies; and may be obtained by exposing them to a red heat. Carbon is capable of crystallisation, though not by art, and in that state is called *diamond*.\*

What is Oxygen?

Air, mentioned in the first chapter of this work as the fluid substance which composes the atmosphere, is formed by a mixture of two distinct elements, one called nitrogen, or azote, the other oxygen: and both are kept in their gaseous state by heat, which is called caloric. Oxygen is, therefore, an element or simple substance diffused generally through nature, and its different combinations (for, like caloric, it does not exist by itself) are essential to animal life and combustion. It is, in fact, the most active and operative agent in nature, and the principle of acidity and combustion. So wholesome and necessary is oxygen to life, that it is often called vital air.

*Operative*, having the power of acting; active. *Agent*, an actor; a thing or person possessing the faculty of action. *Essential*, necessary.

What are the properties of Nitrogen or Azote?

Nitrogen is a substance also generally diffused through nature, and particularly in animal bodies, and causes great changes in those absorbing or exposed to it. This gas or spirit, combined with oxygen and hydrogen, neither produces light, heat, nor combustion, but serves to dilute the

\* See Chapter xiv., article Diamond.

others : of itself it is hurtful to animal life. Nitrogen makes the principal part of the salt we call *nitre*.

What is meant by combustion ?

The decomposition of bodies by the action of fire ; the property by which combustible bodies absorb the oxygen of the atmosphere. The greater access the air has to a burning body, the more rapid and complete is the process.

*Combustible*, apt to burn. *Access*, the means or liberty of approach to anything.

Are all bodies equally combustible ?

No ; some are more so than others, and burn with a bright flame, as wood, dry vegetables, resins, oils, fats, &c. ; others with difficulty, and without any sensible flame, as soot, coal, the ashes of plants, &c. There are bodies, also, which are incombustible—that is, incapable of taking fire, as some alkalies and earths, &c.

What new elementary substance has been recently discovered in atmospheric air ?

Ozone, a gaseous substance generated from the oxygen when the air is overcharged with electricity. It possesses a powerful odour, perceptible when it is evolved in electrical operations. Hence its name from the Greek verb, to smell. It exists in small quantities, both in air and water.

*Generated*, produced from. *Evolved*, brought out.

What are its qualities and where is it most abundant ?

In excess, it is a violent poison, producing diseases of the respiratory organs, as catarrh, bronchitis, and other similar affections ; but, in sufficient quantity, it destroys the pestiferous odours of organic decomposition. It is found, not in crowded or filthy localities, but on mountain heights, over water, and wherever vegetation is unusually abundant.

*Catarrh*, an inflammatory affection, commonly called, a cold. *Bronchitis*, inflammation of the bronchi, or tubes in the throat, which convey air into the lungs—in common phrase, the windpipe. It is formed from the Greek words expressing the same.

By whom was Ozone discovered ?

By the eminent German chemist, Professor Schonbein, who has also invented a delicate test by which the medical men can discover the presence of this gas, and estimate

the quantity in the air by measuring it with an ozonometer, an instrument for that purpose.

What is a test ?

A substance, which, being added to another substance, tests, or distinguishes, its chemical nature or composition.

What is Caloric ?

Caloric is a mere name of that element or property which, combined with various bodies, produces the sensation of heat, while it is passing from one body to another. It exists in all bodies ; it is an element we are ever in want of, and thus it is hid in everything around us, and combines with all matter, however different may be its nature or properties.

*Element*, the first principle of anything.

What is meant by Gas ?

A name given to the volatile, invisible parts which escape from different bodies, and which cannot be retained and collected,—at least without great difficulty, and by the mixture of other substances. There are several gases, some harmless and salutary, but many extremely noxious, such as those arising from the putrefaction of animal bodies, the burning of charcoal, corrupted air at the bottom of mines, cellars, &c.

*Salutary*, wholesome, healthful. *Noxious*, hurtful, unwholesome. *Putrefaction*, decay.

How is the inflammable gas procured, which lights the streets of our towns, churches, shops, &c. ?

From coal, burnt in furnaces for the purpose, the gas being passed through metal pipes, conveyed underground to the places where the light is required : this, escaping at the orifice prepared for it, is set alight when wanted, and burns with a brilliant flame. This gas consists of hydrogen and carbon : and the oxygen of the air, combined with the hydrogen, causes light as long as hydrogen and oxygen exist and combine.

*Orifice*, opening, hole.

What is Hydrogen ?

One of the most abundant principles in nature ; and 15 parts of it, combined with 85 of oxygen, form water. It is only met with in a gaseous form ; it is also very inflammable, and is the gas called the fire-damp, so often fatal

to miners ; it is the chief constituent of oils, fat, spirits, &c., and is always produced from water.

*Constituent*, that which is necessary to the subsistence of anything.

When was gas first used ?

It was known, but not understood, from very early ages. Ancient history speaks of "altars" in Greece lighted by fire flowing from the earth, sacred to the gods. Alexander the Great saw at Ecbatana, the Persian capital, a "gulf of fire streaming continually." This is supposed to have been naphtha. The Chinese were the first to turn it to use. In the neighbourhood of Pekin natural gas escaped from the earth.

How did they collect it ?

They laid down the hollow canes of the bamboo as pipes, and attached these pipes at one end to pipes of clay, to prevent its taking fire, except at the burners ; and thus lighted their houses and streets.

Whence does this gas proceed ?

That in present use for lighting our towns and dwellings, exists wherever there are beds of coal. Oozing from these, it causes those frequent and fearful explosions which occur when it escapes too abundantly, or becomes ignited by contact with flame.

How then is gas conveyed to those districts where no coal is present ?

It was found that it could always be distilled from coal, but for a hundred years after this discovery, it was only used in interesting experiments, and described as an inflammable air or spirit. In fact, the word gas is derived from an old German word signifying air or spirit.

When was it put to use in this country ?

In 1790 it was employed by a Mr. Murdock, of Cornwall, to light him in his nightly walks, by burning it in bladders. He then conceived that it might be conveyed through pipes ; he succeeded, and lighted his own house and offices at Redruth, &c. In 1813 its manufacture extended to London. Now every town of any size or importance has its gas-works. It is also frequently burnt in stoves, so constructed as to heat churches and dwellings, and even as a cooking apparatus.

What is Naphtha ?

A native liquid bitumen or pitch occurring in springs underground. In its native state, it is a whitish, transparent fluid. It issues from the earth in many localities. At Baku, near the Caspian, it is so plentiful, that wells dug in the sand yield quantities daily; it is likewise found in Burmah, near Rangoon.

What is its use?

It enters into various compounds in the arts and manufactures; it is also burnt in lamps, but requires great caution from its excessive inflammability. For these purposes it is usually procured by distillation, from coal-tar and petroleum.\* Naphtha is produced from the coal during the process of gas-making.

Was gas the first kind of light adopted for towns?

No; somewhere about 1667, glass lamps filled with oil were adopted, but their light was very feeble. Before then people had links or torches carried before them, by their servants or the link men, and the poorer sort carried lanterns.

What is Chalk?

A white fossil substance, by some reckoned a stone, but of a friable kind, which cannot therefore be polished as marble; by others more properly ranked among the earths. It is of two sorts, one a hard dry chalk, used for making lime; the other a soft, unctuous kind, used in manuring land, &c. Chalk always contains quantities of flint-stone, and the fossil remains of shells, coral, animal bones, marine plants, &c.; from which circumstance there can be no doubt that *chalk is the deposited mud of a former ocean*. The chemical name of chalk is carbonate of lime. It effervesces strongly with acid.

*Effervesces*, to froth or foam up. *Deposited*, left, placed on anything.

Where is chalk found?

In large beds or strata in the earth. Chalk forms an important feature in the scenery and geology† of England, from its great extent, and also causes the whiteness of its sea-cliffs. Scotland and Wales are entirely without chalk. The white chalk is found, with interruptions, over a space above eleven hundred miles long, extending from the

\* See Oil-springs, p. 103.

† See Chapter xvi., article Geology.

north of Ireland, through England, France, Belgium, Germany, Poland, and Southern Russia, to the Crimea, with a breadth of more than eight hundred miles. The Island of Crete, now called Candia, situated in the Mediterranean, was formerly noted for its chalk. This substance is very useful in many of the arts and manufactures.

Where is the Crimea?

The peninsula of the Crimea is a part of Russia, lying on the Black Sea, by which it is bounded on the west and south.

Are there any other kinds of this earth besides the common white chalk?

Yes; there are various kinds of chalk, distinguished by their different colours, as white or black, &c., found in various parts of the world, of great use to the painter, both in oil and water colours, and for drawing on paper, &c.

What is marble?

A kind of stone remarkable for its great hardness and firm grain, which causes it to be susceptible of the finest polish. It is dug in great masses from pits or quarries, and is much used in ornamental buildings, as statues, altars, tombs, chimney-pieces, &c. The word is derived from the French *marbre*, marble. Marble is supposed to be formed, deep within the bowels of the earth, from a loose and porous carbonate of lime, subjected to enormous heat and pressure.

*Susceptible*, easily receiving an impression. *Porous*, full of holes, or interstices.

Are there different sorts of this stone?

Marbles are of many different kinds, usually named either from their colour or country; some of one simple colour, as white, or black; others streaked or variegated with different colours in various forms. Marbles are of two kinds, ancient and modern; the ancient are those found in quarries now lost or inaccessible to us, and of which there are only some wrought pieces remaining;—the modern, those from quarries still open, and out of which blocks of marble continue to be taken.

In what countries is marble found?

Great Britain, France, Spain, Italy, Africa, Egypt, and many other countries, produce marbles of different colours

and qualities ; some more beautiful, valuable, and more highly esteemed than others, as those of Egypt and Italy, &c. Those, also, of different places in the same country, frequently differ from each other in quality and appearance. Of the European marbles, that of Italy is the most valuable.

What kind appears to have been held in the greatest esteem by the ancients ?

A beautiful white marble, called the Parian ; of which the Grecian statues were mostly made. It is supposed to have taken its name from the Isle of Paros, in the Mediterranean, by some ; but by others from Parius, a famous statuary, who made it celebrated by cutting a statue of Venus in it. Parian marble is often mentioned by ancient authors.

*Statues*, figures of men, animals, &c., cut in stone or marble.

*Statuary*, one who makes statues.

Who was Venus ?

The goddess of love and beauty, who was worshipped in the idolatrous ages, when men in their blind ignorance knelt down and worshipped stocks and stones, which their own hands had fashioned after the likeness of things on the earth, or imaginary creations of their fancy ;—or, again, the sun, moon, and stars, instead of the one and only true God. In those times, every nation had its peculiar deities, to whom were paid divine rites and honours, and costly temples were raised to their names : these deities were often divided into two classes, superior and inferior.

What nation especially adored her ?

Venus was one of the Grecian goddesses, supposed by them to have sprung from the froth of the sea. Kings and celebrated warriors, and sages, too, after death, frequently received divine honours ; as Confucius, the founder of the Chinese empire, who, after death, was worshipped by that people as a god. Romulus, the first king of Rome, likewise, was thus adored by the Romans ; and many similar instances of the same species of idolatry amongst other nations might be recorded.

*Deities*, or *Deity*, the nature of God. *Idolatrous*, given to the worship of idols. *Superior*, higher in rank than another. *Inferior*, of a lower rank. *Sage*, a wise man.



## CHAPTER XIV.

GOLD, SILVER, TIN, LEAD, BLACK LEAD, PLATINA, SULPHUR, ARSENIC, GEMS OR PRECIOUS STONES, AS DIAMONDS, RUBIES, EMERALDS, TURQUOIS, PEARLS, MOTHER-OF-PEARL, AND IVORY.

### What is Gold?

The purest and most precious of metals: it is sometimes found in solid masses, as in Hungary, Transylvania, and Peru; in the form of grains, as in the West Indies; in a shape resembling the branches of plants; in thin plates covering other bodies, as in Siberia; sometimes in a crystal form, but chiefly in a metallic state, and in the form of grains.

What is it called when found in a perfect metallic form?

Native gold: it is, however, seldom met with perfectly pure, being frequently alloyed with silver, copper, iron or platina; sometimes concealed in other minerals, from which, if sufficiently abundant, it is extracted by art.

Where and in what manner is gold generally found?

All parts of the earth afford gold, though with great difference in point of purity and abundance. It is chiefly obtained from mines. Many rivers contain gold in their sands, especially those of Guinea. Gold mines are of rare occurrence in Europe, but it is found in some of its rivers; among its mines, those of Upper Hungary are the most considerable.

What Eastern countries are rich in this metal?

China, Japan, and many parts of Asia abound with it: the mines of Siam are the most productive. It is also found in the eastern parts and interior of Africa, where gold dust is collected in great quantities from earth deposited by the rivers. But it is in America that gold is most abundant, particularly in the South American mines, those of Brazil and Chili, and in the state of California. Gold has been found even in Great Britain, though in very small quantities; and very recently in Australia, which promises a greater abundance than has yet been boasted by any country.

*Guinea, a country of Western Africa.*

What are the uses of gold?

It is used for money, jewellery, plate, &c. It is also employed in various ways in the arts.

What is the character of gold?

Gold is so ductile and malleable, that an ounce of it may be drawn into a thread of 73 leagues in length; or beaten into 160 leaves of 9 inches square, and thin enough to be carried away by the slightest wind. It readily assumes any form that human art can bestow upon it: its colour is unalterable, and the beautiful polish of which it is susceptible renders it the best of all metals for ornamental purposes. It is indestructible by air, water, or fire. Gold is the heaviest of all metals, except platina: it is not very elastic, nor very hard.

*League*, a measure of length containing three miles. *Indestructible*, incapable of being destroyed.

Is not the use of gold very ancient?

Yes; it appears to have been very early known to the inhabitants of the world. In the thirteenth chapter of Genesis, Abram is spoken of as very rich in silver and gold; and in the second chapter of the same book, the "land of Havilah" (now in the eastern part of Arabia Felix), is pointed out as having gold, and that it was "good." Arabia was famed for the fineness and quality of its gold. In the time of Solomon, the gold of Ophir seems to have been much esteemed, as it is recorded that the gold used in the building of the Temple was brought from that place by the merchant-vessels of Hiram, King of Tyre. The situation of Ophir is much disputed; it is supposed by some to have been situated somewhere in the East-Indies.

What is Silver?

A beautiful, white, shining metal, next to gold in value, and, like that precious substance, of equal antiquity. It is chiefly found in Sweden, Norway, and the polar latitudes; when it occurs in hot climates, it is generally amidst mountains covered with perpetual snow.

*Latitude*, breadth, extent; in geography, the distance of a place in degrees, north or south, from the Equator or imaginary line which divides the earth in the centre. *Occur*, to happen.

Where are the richest Silver Mines found?

The richest and most important silver mines in Europe are those of Königsberg, in Norway; in Spain, those of Andalusia. It is in America, however, that silver is most abundant, especially in the centre of the Andes (one of which is the celebrated mountain of Potosi); the mines of Mexico are rich in this metal.

What is the character of silver?

With the exception of gold, silver is the most ductile of all metals; a single grain may be extended into a plate 126 inches long and half an inch broad. It is capable of still further extension; but its tenacity is even inferior to that of iron or copper. A silver wire one-tenth of an inch thick will scarcely bear a weight of 290 pounds, whilst a gold wire of the same thickness will support nearly double that weight. Like other perfect metals, it is fixed and unalterable in the heat of an ordinary fire, but may be volatilised, being sometimes found in the soot of chimneys where large quantities are melted.

*Volatilised, made to fly off by evaporation.*

In what state is silver generally found?

Rarely in a state of purity, being frequently mixed with other metals, as gold, &c. Masses of native silver are of no determinate form; being found sometimes in small branches, sometimes in threads, or very frequently in leaves, as in the Siberian mines. Native, or pure, silver is chiefly found in the mines of Potosi. Silver was used as money in commerce 1100 years before the foundation of Rome.

*Commerce, trade of one nation with another, or different persons, &c., with others.*

What is Tin?

A white metal, softer than any other excepting lead, more elastic, and more sonorous. It is an *imperfect* metal—that is, compounded of two other metals, supposed to be silver and lead. Though tin is the lightest of all metals, its ore is, when rich, the heaviest of all metallic ores. Like other imperfect metals, it has both smell and taste; it is less ductile than some harder metals, though it may be beaten into very thin leaves; it fuses so quickly,

that it requires a heat much less than is sufficient to make it red hot.

*Sonorous*, sounding when struck. *Ductile*, pliable. *Fuses*, melts.

Was not the use of tin very early known?

Tin was found in Britain from the earliest ages; the Phœnicians traded to Cornwall for this metal 600 years before Christ.

Where are the principal tin mines?

The principal tin mines of Germany are those of Bohemia, Carinthia, &c.; whole kingdoms, such as Sweden, Denmark, Norway, &c., have no tin mines, but are supplied with tin exported from England, in which the mines of Cornwall and Devonshire are the most abundant; tin is also found in the Molucca Isles, Spain, Sumatra, Mexico, and Chili.

*Exported*, sent out to other countries.

Where are the Moluccas?

To the south of the Philippine Isles, in the Chinese Sea.

In what state is tin generally found?

Tin is sometimes native or pure, but most frequently alloyed with other metals; the working of tin mines is very difficult, on account of their great depth, and the hard rocks which obstruct the progress of the miners, who are often obliged to cut through them. This metal is very useful in the making of domestic utensils, for coating the inside of copper and iron vessels, and for various other purposes.

*Obstruct*, to prevent, to stand in the way.

What is Lead?

A coarse, heavy, impure metal, of a pale, livid white colour: it is so soft and flexible, that it is easily cut with a knife, and rolled out into sheets, &c.; it is very fusible, and, excepting tin, melts much sooner than any other metal; but is not so hard, ductile, elastic, or so sonorous as the rest. Next to gold, platina, and mercury, it is the heaviest of the metals, being eleven times heavier than an equal bulk of water. Lead loses its malleability in proportion as it is heated; as soon as it melts it calcines, and greyish coloured ashes are formed on its surface; when it is returning from a fluid to a consistent state, it

is easily divided into small grains or powder, or formed into shot for guns, &c. Lead was in common use among the ancients.

*Flexible*, yielding, easily bent.

Where is lead found ?

In various countries; but it abounds principally in Great Britain, particularly in Scotland and Derbyshire: it is found in several kinds of soils and stones. Lead is a metal of much use; it easily melts and mixes with gold, silver, and copper; hence it is used in the refining of gold and silver, as it collects all the dirt and impurities from them; it is much used in building, particularly for covering gutters, pipes, &c.; lead is also used in varnishes and oil-painting, and makes the basis of the glazing of all the earthen and pottery wares.

*Refining*, cleansing, purifying. *Varnishes*, preparations for beautifying and preserving various articles.

What is peculiar to the ore of lead ?

The ore of this metal is so poisonous, that the steam arising from the furnaces in which it is worked infects the grass of all the neighbouring places, and kills the animals which feed on it: culinary vessels lined with a mixture of tin and lead are apt to convey pernicious qualities to the food prepared in them. There are various preparations of lead, serving for different purposes.

*Infects*, corrupts. *Culinary*, adapted to the purposes of cooking. *Pernicious*, hurtful, dangerous. *Ore*, the mineral soil, earth, or stone, which contains the metal and is dug out of the mines.

Is Black Lead a metal ?

Not exactly; it is a kind of mineral, of a deep shining black or blueish colour, but soft and unctuous; it is insoluble by acids, and infusible by fire. Black lead has been found in many parts of the world, in a state of greater or less purity; but it is the English black lead which is the most esteemed and the best.

*Insoluble*, incapable of dissolving. *Infusible*, not capable of being melted.

Is black lead a proper term for this mineral ?

No; because, in reality, there is not a particle of lead in it. On the spot where it is procured, it is called by

two or three different names, but the most usual is plumbago.

Where is the best black lead found ?

The best and greatest quantity is found in England, in a mine, near Keswick, in Cumberland. It is much used for pencils or crayons, for designing ; for this purpose it is sawn into slips, and fitted into a groove in a strip of the softest wood, as cedar, &c., over which another is placed and fastened down with glue.

*Designing, drawing or sketching landscapes, &c.*

What is Platina ?

A metallic substance, of a later discovery than the metals already described ; and analogous to the perfect metals, especially gold,—many of whose properties it possesses.

*Analogous, bearing a resemblance.*

From whence is it supposed that its name of platina is derived ?

It is the diminutive of *plata*, silver, to which it appears very similar ; platina being a silver-coloured metal, in small grains,

*Diminutive, a word lessening the meaning of the original.*

From whence is it obtained ?

From South America, especially from the provinces of Peru and Quito. It is brought to England in grains of a silvery white ; its colour does not tarnish by air or weather, and appears to be equally permanent with that of pure gold ; it is alike indestructible by fire. Platina is capable of being alloyed with all metals ; is fused with difficulty, but by great labour may be rendered malleable : it is also the heaviest metal, being twenty-one times heavier than water.

*Permanent, lasting.*

Are there any other metals besides the seven already mentioned ?

In addition to the six primitive metals known and used by the ancients, the chemical science of later ages has, by decomposing other earths, added thirty or more to the number of metals, some of them more curious than useful ; several of these are lighter than water. All the metals possess different and distinct properties from each

other. They are divided into two classes, the malleable and the brittle metals. These last may be again divided into two others,—namely, those which are easily, and those which are with difficulty, fused.

What do you mean by Metallurgy?

The art of obtaining metals from their ores, comprising the processes of assaying, refining, smelting, &c. By assaying is meant the particular manner of examining every ore or mixed metal, according to its nature, so as to discover, not only what metals and what proportions of metal are contained in ores, but also what other mineral substances or earths may be obtained from each ore.

What do the terms Refining and Smelting signify?

Refining is the art of rendering the metal more fine and pure. Smelting means the melting of a metal from its ore in a smelting furnace, in order to separate the metallic parts from the sulphur, arsenic, and the earthy and stony substances with which they are combined. The term smelting is properly confined to large works, wherein ores from the mines are smelted down and separated. In speaking of works in a smaller way we do not say smelting, but melting.

What is Sulphur?

An inflammable fossil substance, of a dry, solid, friable nature, melting with a small proportion of heat; when fired in the open air, burning almost entirely away with a blue flame and noxious vapour. Mineral sulphur, probably, is always forming and combining within the earth: it is abundantly diffused in many places, especially where metallic minerals are found; but more particularly in those districts where subterranean fires and volcanoes exist. Sulphur is also found combined with many different substances.

Describe the nature of sulphur, and the places where it is most found.

Sulphur almost pure, called native or virgin sulphur, is found in volcanoes and grottoes, in the form of transparent crystals; but the greatest quantity which exists naturally is combined with metals in ores. Sulphur is both fusible and volatile, which qualities cause it to be procured from those minerals by the process of distillation

and sublimation ; it unites easily, in different degrees, with all metallic matters, excepting gold, platina, and zinc.

*Sublimation*, the act of raising in a chemical sense by the force of fire.

Are not its uses very extensive ?

Yes, both in the arts and chemistry : it is well known to be a principal ingredient in the preparation of gun-powder and fireworks ; it is also used for whitening wool, straw, silk, &c. ; and many other matters exposed to the vapours of sulphur when burning, quickly lose their colour, which no other substance had been able to destroy. Sulphur is frequently found in mineral waters.

From whence are the greatest quantities of sulphur brought ?

The largest quantities are brought from Saxony, in irregular masses, which are afterwards melted and cast into small rolls. There are about four species of sulphur, namely, the yellow native sulphur, which in its purest state is clear, and of a pale straw colour, found in the gold mines of Peru ; in Hungary, and some other places, the green native sulphur, which is harder than the other, is found in small crust-like masses ; this sort is chiefly confined to Mount Vesuvius : and the grey native sulphur common in Iceland and many other places.

Which is the most rare and beautiful of all the kinds ?

The red native sulphur ; it is mostly of a fine glowing red, very bright and transparent, and is found, like the first-mentioned sort, in the gold mines of Peru. The sulphur in common use is of a pale yellow colour, and possesses a peculiar and disagreeable smell, particularly when heated or rubbed. The greatest part of this is extracted from metallic ores, and commonly called brimstone. This is the sort employed in making matches.

Is there not an acid drawn from sulphur ?

Sulphuric acid, consisting of one part sulphur and three of oxygen. It is prepared by burning sulphur with other materials ; and is frequently called *oil of vitriol*. It is the strongest of acids, and separates all others from the bodies with which they are mixed.

What are its uses ?

It enters so largely into all the arts of life, that its



manufacture affords a striking proof of the value of chemical science\* in promoting individual and national welfare. Without it, neither glass, soda, or soap could be produced so abundantly or so cheaply. To sulphuric acid, also, we owe the whiteness of our linens, and calicoes, and the beauty and cheapness of our paper. Therefore to the chemist, the dyer, the manufacturer, and others, it is invaluable, from its procuring the other acids, carbonates and sulphates, requisite for the various arts.

Is there not another substance also employed in the manufacture of matches ?

Yes ; Phosphorus, a peculiar substance, chiefly of animal origin. It is mostly procured by the decomposition of the phosphoric acid which is found in bones. It was accidentally discovered at Hamburgh, in 1669, by an alchemist named Brandt.

*Alchemist*, one skilled in alchemy.†

What is the nature of Phosphorus ?

It is a solid, inflammable substance, which burns when in contact with atmospheric air. It is used in various chemical experiments, and for making matches, fire-works, &c. It will combine with all metals except gold and zinc, and also with some earths. Some animals, as the glowworm, and some marine animals, possess very peculiar phosphorescent qualities.

*Phosphorescent*, having phosphoric property, emitting peculiar light like phosphorus.

What is Arsenic ?

A heavy metallic substance, very volatile and highly inflammable ; it is so caustic or corrosive to animals, as to become a violent poison in all its states. In its metallic state it is used in several of the arts : it is employed in the manufacture of factitious metals ; it is of use to the dyer in forming some of his colours ; and for that purpose is generally combined with potass. Arsenic is also used in the making of small shot, and in the manufacture of glass, to which it gives transparency ; in whitening copper ; in calico printing ; in the preparation of colours for the painter ; in the working of platina, and other metals, as it renders them more fusible.

\* See Science, Chap. xviii. † See Chap. xviii., article Chemistry.

How is the white powdered arsenic prepared ?

By submitting the ore to a strong heat in a peculiar kind of furnace ; this produces a dark grey powder, which is again heated in close iron vessels ; thus separated from its impurities, the arsenic is obtained in thick, solid masses. These, by exposure to the air, fall into a fine, white powder.

*Caustic*, dry, burning. *Corrosive*, apt to corrode, to eat away, to penetrate.

From what is the word arsenic derived ?

From a Greek word, signifying *masculine*—powerful (as a poison). Arsenic is dug out of mines in Saxony, near Goslar, and in England, from the Mendip Hills, in great quantities. It has so strong a corrosive quality as sometimes to burn the hands and feet of the miners ; it is a deadly poison for all known animals. This poisonous mineral is not found native in its perfect form, but buried in ores of various kinds, being united with, and contaminating, many metallic ores.

*Contaminating*, corrupting.

What are some of the circumstances under which metals are found ?

Distributed over the surface of the earth in vast quantities and present in a variety of forms, we have seen that few of them are often found in a simple state. If so found, they are called *native* ; when with other bodies, they are *mineralised*, and, in this form, called *ores*. Combinations of metals one with another are called *alloys*.

In what places are they found ?

In the large fissures of rocks, when they are called *veins* ; and often in beds of earth. Many of the minor metals, discovered in modern times, have been procured from *alkaline earths*, by means of galvanism. The celebrated Sir Humphrey Davy was the first who adopted this process.

What are their general characters ?

They are lustrous, opaque, but do not give out light, although in general they reflect it. All of them combine with oxygen in a greater or less degree ; and form *acids* and *oxides*. All metals are conductors of heat and electricity. All, except mercury, are solid at the tem-

perature of the air; but all may be liquefied by heat, though its degree is very different for different metals.

Have metals any taste, and can they be dissipated in vapour?

When pure, all metals are tasteless, even those, as zinc, copper, and mercury, which in combinations produce substances possessing a strongly-marked taste. Most metals are highly *fixed* substances; but some, as mercury, arsenic, &c., are readily formed into vapour at a high temperature, and are so volatile as to be sometimes distilled.

Into what classes are metals divided?

Into four: those whose oxides are alkalies, as *metals of the alkalies*; *metals of the alkaline earths*, whose oxides are earthy, as lime; *metals of the earths proper*, whose oxides are earthy powder, insoluble in water, and not alkaline; and *metals proper*, or metals in their uncombined state. These last have two divisions: *common metals*, as iron, lead, copper, combustible, readily oxidised, and which rust and tarnish in air; *precious or noble metals*, as gold and platina, not combustible, and not readily tarnished or oxidised.

What do you mean by Gems?

The word gem is used as a common name for all precious stones or jewels; they consist of the siliceous earths; and are much valued for their lustre, transparency, colour, hardness, and rarity, as diamonds, rubies, &c. There are many different kinds of precious stones, each kind distinguished by its peculiar character.

How are they divided?

Into the pellucid gems, which are of great lustre and extremely hard, as the diamond; semi-pellucid, those which are not so transparent and clear, but also of great beauty; those of one colour, as the emerald or turquois; and some variegated or veined with different colours.

In what forms are gems sometimes found?

In regular shapes, with a natural polish, near the beds of rivers after great rains; these are of the pebble kind: and likewise of irregular shapes, with a rough coat, in mines and the clefts of rocks. Pearls, though not stones, are also ranked among the number of gems.

*Pellucid*, clear as a drop of water. *Semi-pellucid*, only half pellucid.

### Describe the Diamond.

The diamond is a precious stone, which ranks the first amongst the gems, and is valued for its beautiful lustre; it is the hardest of all stones, as well as the most valuable. Its most perfect colour is white. A diamond in the natural state as it comes out of the mine, and before it is cut, is called rough, because it has no brilliancy, but is covered with an earthy crust. The diamond is the adamant of the ancients, hence the expression "hard as adamant," from its being the hardest substance in nature. The cutting of diamonds is a work of labour, and requires great skill; the polishing is performed by a mill of simple construction.

Where are they mostly found?

In yellow ochreous earths, under rocks of stone; in mines; and likewise detached in torrents, which have torn them from their beds. In former times, all the diamonds that were known were brought from the famous mines of Golconda, in Hindostan; the islands of Molucca and Borneo have also produced many valuable stones; the diamond mines of Golconda are now so exhausted, as to be thought not worth the expense of working; those now brought to Europe are chiefly from the Brazils, in South America. They are seldom found above a certain size.

What is meant by Ochreous?

Consisting of ochre, a kind of earth, with a rough and dusty surface, composed of fine, soft, clayey particles, which readily separate in water. There are various coloured ochres, as red, yellow, blue, green, &c.; they are very useful in many of the arts.

What term is used to denote the quality of the diamond?

In speaking of the value of diamonds, we distinguish them by "diamonds of the first water," meaning those which possess the greatest perfection and purity, which ought to be that of the clearest drop of water: when they fall short of this perfection, they are said to be "of the second or third water," and so on till the stone may be properly called a coloured one.

What is the Ruby?

A beautiful gem of a red colour ; in its perfect state it is of great beauty and value. The ruby is often found perfectly pure and free from all spots or blemishes ; but its value is much more frequently lessened by them, especially in the larger stones. It is very hard, being second only to the diamond in this respect ; and is often naturally so bright and pure on the surface as to need no polishing. The colour of rubies varies from the deepest to the palest red in different degrees, all having more or less of a purplish tinge, which is more plainly perceived in the deep coloured than in the pale specimens.

*Specimen*, a sample, a part of anything shown or found.

Where are rubies mostly found ?

Frequently in gold mines. We have the true rubies only from the East. The Isle of Ceylon has long been celebrated for the ruby ; they are sometimes found in a river which descends from the mountains towards the centre of the island ; these are brighter and more beautiful than those in other parts, but very rare. In Europe, crystals are frequently found tinged with the true colour of the ruby, but they want its lustre and hardness.

Describe the Emerald.

It is a precious stone of a beautiful transparent green colour ; when in a state of the greatest perfection, it is nearly equal to the ruby in hardness. The finest and best are found in America, chiefly about the mountains of Peru ; and some at a few places in the East. The emerald is of various shades of green, from the deepest to the palest colour. This gem is capable of being counterfeited, as are most of the precious stones, there being even false diamonds ; but the true gems may be known by their extreme hardness and brilliancy.

*Counterfeited*, imitated, false ones substituted for the true.

What is the Turquoise ?

A beautiful blue stone ; it is one of the softest of the gems, though some specimens are much harder than others ; they cut easily, and are often used for seals, as they admit of being engraved upon. The turquoise is easily imitated, and that often so perfectly as to render it very difficult to discover the counterfeit from the true gem.

In what countries are they found ?

The Oriental turquois comes from Persia, the Indies, and some parts of Turkey ; the turquois is also found in various parts of Europe, as Germany, Spain, and France.

What is Engraving ?

The art of cutting metals or precious stones, and representing upon them figures, letters, &c. Engraving is a term more especially used to denote the art of producing figures or designs on metal, wood, stone, &c., for the purpose of being afterwards printed from them on paper.

Who was the inventor ?

It has been ascribed to a goldsmith of Florence, about the year 1460, though the art appears to have been known at a much earlier period ; the ancients are well known to have excelled in engraving on precious stones, there being many antique gems engraved, which surpass anything of the kind produced by the moderns.

*Antique*, belonging to the ancients, worked by them.

What are the tools usually employed ?

Those of iron or brass. There is plain proof, both from sacred and profane history, that the graver's art was known to the ancients. This art is frequently alluded to in the Bible.

Who brought the art of engraving on wood and metal, and taking off impressions on paper, &c., to great perfection ?

Albert Durer, a celebrated painter of Germany. Engraving is performed with a sharp pointed instrument called a *graver*, by means of which figures, landscapes, &c., are traced upon a flat surface of metal ; the lines are then filled with ink or a similar composition, and the paper pressed on it. When taken off, an exact copy of the plate is impressed upon its surface.

Describe wood engraving.

The subject is drawn on a block of pear-tree wood, with a black-lead pencil ; the wood is then cut away so as to leave the pencil lines raised. Ink is then applied, and by pressing damp paper on the block, impressions are obtained.

Is not stone also used for this purpose ?

Yes. This is called Lithography ; a species of engraving

from which impressions can be taken much more quickly and economically than from metal; one stone sufficing for many thousand perfect copies. The drawings are made upon it with crayons composed of oily materials. The stone is then washed with water, and the ink applied, which adheres to the drawing, but not to the rest of the stone. The block is then passed through a press, and the impressions taken off to print.

You describe Pearls as being ranked among the number of gems, although they are not stone; what kind of substance are they?

Pearls are excrescences found in the shells of a large species of oyster; all these oysters do not contain pearls, which are supposed to be produced by a disease of the fish. The best pearls are generally taken from the most fleshy part of the oyster, near the hinge of the shell, but they are likewise found in all parts of the fish, and adhering to the shells. Pearls, from many allusions made to them in the Old Testament, were not only known to the ancients but regarded with the same high value as costly and precious gems, as they are in the present time.

How do they get the oysters which contain them?

By diving under water and picking the oysters from the large beds at the bottom of the sea; or the rocks to which they adhere. The divers cast all the oysters they take into their boats, and carry them to the shore, where they deposit them in heaps; they are then left till they become putrid, this being necessary in order to remove the pearls easily from the rough matter by which they are surrounded.

What sea produces the best and greatest number of pearls?

The finest and greatest quantities are obtained off the coast of Ceylon; the pearl oyster is also found in the seas of the East Indies; in those of America, and in some parts of the European seas, but these last are much inferior. The Oriental pearls are the finest on account of their size, colour, and beauty, being of a silvery white; while the Occidental pearls are smaller, and frequently tinged with the yellow or blackish hue.

*Tinged, slightly coloured.*

Does not the pearl oyster produce a substance called Mother-of-Pearl?

No; the beautiful substance so much used in inlaying boxes, and for ornamental knife-handles, &c., is produced from the shell, not of the pearl oyster, but of another sea-fish of the oyster kind.

What is Inlaying?

The art of ornamenting a plain surface of wood, or other material, with thin slices or leaves of a finer wood, of a different kind; as mahogany inlaid with ebony, ivory, or other substances. There are two kinds of inlaying; one, of the more ordinary sort, which consists only of compartments of different kinds of wood, inlaid with one another; the other, requiring greater skill, represents flowers, birds, and other figures.

*Compartment, a division, a separate part.*

How is inlaying performed?

The wood or substances intended to be worked are sawn into slips, and cut into the required forms: being brought to their proper thickness, they are carefully joined, and strongly glued down on a block or ground of dry wood, &c.

What is Ebony?

A thick, hard, black-coloured wood, growing in the countries of the Levant, &c.; there are, however, several black woods of different kinds which are called ebony.

What is Ivory?

The tooth or tusk of the elephant, which grows on each side of his trunk; it is something like a horn in shape. Ivory is much esteemed for its beautiful white colour, polish, and fine grain when wrought. Ivory has been used from the remotest ages of antiquity; in the Scriptures we read of Solomon's ivory throne, and also of "vessels of ivory," and "beds of ivory;" by which it appears to have been a chief article of luxury, as well as of trade.

*Remotest, most distant.*

Of what countries is the elephant an inhabitant?

They are very numerous throughout Asia and Africa. The elephant is the largest quadruped now in existence; it is extremely sagacious, docile, and friendly; in the



countries where they live they are trained to useful labour, and by their great strength are enabled to perform tasks which a man or horse could not accomplish. Among the native princes they were, and even still are, used in war, and for hunting the lion, tiger, and other beasts of prey. With their long trunk, or proboscis, they can perform almost everything which man can with his hands.

*Quadruped*, an animal with four feet.

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## CHAPTER XV.

STARCH, ARROW-ROOT, TAPIOCA, ISINGLASS, CAVIARE, THE VINE, WINE, HONEY, GIN, RUM, MALT, BEER, BRANDY, VINEGAR, INDIGO, GAMBOGE, LOGWOOD, TAR, PITCH, CAMPHOR, MUSK, MYRRH, FRANKINCENSE, AND TURPENTINE.

What is Starch ?

A powdery sediment procured from the bottom of vessels in which flour or meal has been steeped in water. Pure starch is of a fine white colour, without taste or smell ; it will not dissolve in cold water, but with warm it forms a jelly ; it is usually made by working the flour with the hands under a stream of pure water, till the water ceases to flow off white ; if the water which has washed the flour be evaporated, a white powder is left, which is the starch.

*Sediment*, a settlement deposited at the bottom of anything.

For what is starch used ?

To stiffen linen after washing ; to make hair powder ; and for other purposes in the different arts.

Is starch obtained from any other vegetable besides wheat ?

All farinaceous vegetable substances afford it, as the potato, horse-chestnut, &c. Starch being the nutritive part of the vegetable, forms an excellent food for invalids, and constitutes the principal part of arrow-root, tapioca, &c. ; the different flavour of these substances being derived from the mixture of a small portion of foreign matter peculiar to the plants which yield them. Starch is procured from potatoes by crushing them to powder, and then working it after the manner of wheat starch.

What is Arrow-root ?

The starch obtained from the root of an American and Indian plant by pulverising it. It is often adulterated by potato starch. And this is even sold instead of it, for they resemble each other so closely that they can hardly be distinguished.

*Pulverising*, reducing to powder. *Adulterated*, corrupted by foreign mixture.

What is Tapioca?

Tapioca is another kind of starch, obtained from the root of the *manioc* plant, which is cultivated in most hot climates, in Asia, Africa, and America. A flour is also prepared from it, which is used for the making of bread; thus the *manioc* plant is as useful to them as corn and rice are to the Europeans. It is particularly cultivated in America and the West Indian islands, where it forms a very important article of food for the Negro population.

*Negro*, black; a name given to the black inhabitants of Africa. *Population*, inhabitants of a place or country.

What is Isinglass?

One of the purest and finest of *animal* glues. It is the produce of a fish called the sturgeon, which inhabits the seas of Northern Europe and America.

What part of the fish is it prepared from?

From the air bladder and sound, which are very large: these are taken out while fresh, cut open and washed, then exposed to the air a short time to stiffen; the outside skin is then taken off, and the remaining part formed into rolls, fastened together with pegs and hung up to dry. The isinglass is then separated into threads of different sizes, or formed into flakes. Immense quantities are prepared in this manner, in Russia especially, every year.

What are its uses?

Dissolving readily in water or milk, it yields a mild nutriment for the sick, and enters into the composition of many delicacies for the table, such as jellies, &c. It is likewise useful in many manufactures, being mixed with gum to give lustre to silk and satin; for the making of court plaister and post-office stamps, &c., and in the fining of various liquors. Gelatine, now much used on account of its being less expensive, is a similar preparation, but of an inferior quality.

What else does the Sturgeon supply ?

Its roe furnishes the delicacy called caviare, being in fact merely that part separated from the membranes, and washed in vinegar and white wine, and dried in the air. It is then well salted, put into a bag, and all the remaining liquor squeezed out, and lastly packed up in barrels ready for sale. This is the method of preparing it in Russia, where its consumption is very great. It is principally exported to Italy, the demand for it in England being small. The best is dry, and of a brown colour, and eaten with lemon juice on bread. The flesh of the sturgeon is sent all over Europe, and is a great delicacy.

To what other use is the fruit of the Vine applied besides drying it for raisins, as described in the sixth chapter ?

This well-known plant, called the vine, has been an object of culture from the earliest ages of the world, for the sake of the fermented liquor obtained from its fruit ; soon after the flood, Noah, who appears to have been the first "husbandman," is mentioned as having "planted a vineyard," and drank of the juice of the grape ; in all those countries where it flourishes, it is inseparably connected with their religious rites, and wine, like corn, formed one of the habitual and principal articles which they offered on their altars to the gods whom they worshipped.

*Husbandman*, one who cultivates the fruits of the earth. *Habitual*, customary according to the usual habit. *Altar*, the place where offerings to heaven are laid.

Where do vines grow in the greatest perfection ?

The vine flourishes best in a mild temperate climate, and under a southern sun ; in a climate like our own, the fruit will seldom ripen in the open air, unless in a very sheltered situation, where it has full exposure to the sun ; it equally dislikes a sultry heat ; but so much depends on climate and situation, that many spots beyond those limits are celebrated for their productive vineyards, while others, which from their situation might be expected to furnish the finest wine, do not admit of its cultivation for that purpose. In England vines require to be trained against walls, but in mild climates they grow in open fields, cut

down like our currant bushes or trained up the trees, or on peles for the purpose.

What countries produce the best Wines ?

The wines of France are generally admitted to be the finest ; the principal ones are Champagne, Burgundy, and Claret. Each of these have several varieties, celebrated for their peculiar flavour ; and all named after the different places where they are made, as those above mentioned are from the provinces which produce them. England is principally supplied from the vintages of Spain and Portugal. Italy, Germany, Hungary, Sicily, Greece, and other countries also produce their various sorts of wine, each esteemed in its kind.

*Vintage*, the season for gathering the fruit.

May wine be extracted from other vegetable bodies ?

The word wine is appropriated in a more particular manner to the fermented juice of the grape ; but all sorts of vegetables, fruits, seeds, roots, &c., may be made to afford wine. That produced from apples is called cider ; that from pears, perry. A wine is likewise prepared from honey and water, called mead.

*Appropriated*, applied to. *Fermented*, changed from sweet to sour by heat or action of the parts.

What is Honey ?

A sweet vegetable juice, collected from the flowers of various plants by the bees.

What honey was reckoned by the ancients the best in the world ?

The honey of Hybla, on the east coast of Sicily, and of Hymettus, a mountain of Greece, near Athens.

What other fluid is drawn from wine ?

Spirits ; by this term is understood a volatile fluid, called spirits or alcohol, obtained by evaporation from wine, beer, and all fermented liquors, after the *carbonic acid* gas has been expelled from the vegetable solution in water, which, exposed to heat or distilled, produces spirits of wine, brandy, rum, &c.

*Solution*, that which contains anything dissolved.

What is Distillation ?

The art of separating or drawing off the spirituous

parts of a mixed body from the grosser and more earthy parts by means of heat.

*Spirituons*, consisting of spirit.

What is the vessel called which is used in distilling?

A still. It is a vessel so formed as to collect the vapour, which is the spirit or alcohol separated from the liquid from which it is drawn. This liquid product is itself returned to the still; and the same process is several times repeated, till the alcohol or spirit is sufficiently strong and pure. There are three principal spirits used in this country, as gin, rum, and brandy:

*Product*, thing produced.

What is Gin?

A spirit procured from raw barley, oats, and malt, mixed together in certain proportions: there are several varieties of this spirit, all obtained from grain of some sort, as whiskey, &c. The peculiar flavour of gin is given by infusing a few hops and some of the berries of the juniper fir.

What is Malt?

Malt is barley made to sprout or germinate by moisture and warmth, and then dried to destroy the vitality of the shoot.

*Vitality*, the living principle of bodies.

Why is the grain thus prepared?

To bring out the saccharine matter in the grain, that it may add to the strength and goodness of the beer or other liquor, in the making of which it is used.

*Saccharine*, belonging to sugar.

What is the process?

The grain is immersed in water about two days, till much swelled; it is then laid in heaps, on a frame for the purpose, till it becomes warm and disposed to germinate; it is next spread out, about two inches thick, on the floor of the malt-house. When the saccharine matter is fully developed, it is dried on a kiln or furnace.

*Immersed*, placed entirely under water. *Germinate*, to send forth buds from a seed or root.

What is Beer?

The fermented infusion of malt flavoured with hops. It appears to have been, from a very early period, the favourite drink of all the Teutonic or German races, as the Germans, Danes, Norwegians, Swedes, and also of the English, who received it from their Saxon ancestors. Ale or beer was a common drink in England as early as the fourteenth century, if not before.

Why should it have been peculiar to these nations ?

Probably because the hardy races of Northern Europe required a more easily obtained and substantial beverage than the juice of the vine, which in these cold regions will not flourish above lat. 48°, while barley, rye, and oats will grow in some places as high as lat. 67°.

What is the difference between ale and beer ?

Ale is the liquor from the malt and hops in its first running, and is stronger than beer, of which there are two or three qualities according to its dilution with water.

To what else is the word beer applied ?

To those saccharine liquors partially advanced into the vinous fermentation, and flavoured with peculiar substances, as spruce beer, made from treacle and the essence of the spruce fir ; ginger beer ; and dandelion beer, from the roots of that medicinal plant. Porter, again, is made like beer, of malt and hops ; the colour is imparted by the malt being highly dried, and by the admixture of other ingredients.

What are Hops ?

The blossoms of a graceful climbing plant, which are used in the making of beer, to preserve it and improve its flavour. The hop was introduced into England from the Netherlands, in the year 1525. There are large plantations of hops in many of the English counties, especially Kent, Worcestershire, and Herefordshire.

What is Rum ?

A spirit obtained from molasses, the fluid which drains from the sugar while it is crystallising.

What is Brandy ?

A spirit distilled from any wine ; but the best is procured from weak French wines, which are unfit for exportation. Brandy, whatever wine it has been obtained

from, is at first colourless, and different methods are used to give it the colour by which it is distinguished.

*Exportation*, the act of sending out or exporting.

What is meant by Spirit of Wine,—and is it the same as Brandy?

No; spirit of wine is the simple and very volatile light fluid distilled from wine, called alcohol; it is colourless, and of a strong penetrating taste and smell. Spirit of wine is of great use in chemistry; in dyeing it is used to prepare the stuff to receive other colours; it is besides useful in many of the arts.

What is Vinegar?

An agreeable acid, penetrating liquor, prepared from wine or beer, &c. To make vinegar, the wine or beer is made to undergo a second fermentation, called the *acid* or *acetous* fermentation: the first which the vegetable juice had to undergo, in order to convert it into wine or beer, being called the *vinous* fermentation.

What is the use of vinegar?

For cookery and medicine; the word is derived from the French for wine, *vin*, and *aigre*, sour. The ancients had several kinds of vinegar, which they used as a drink; but it is most likely that these vinegars were very different to that of the present day, and more probably a kind of small wine.

*Acetous*, having the quality of acid. *Vinous*, wine-like.

What materials are used in dyeing or colouring?

Colouring matters are derived from the vegetable and animal kingdoms in great variety; also from mineral earths; from chemical mixtures of salts, metals, &c.; and from some species of insects, as the cochineal.\* With some of these materials, mankind have furnished themselves with different colours for beautifying their various manufactures, and assisting them in the arts.

What are the principal colours?

There are three primary colours, derived from organic bodies, they are red, blue, and yellow. Most of the others are compounds. The first mentioned are *simple*, and incapable of being made by mixtures. Orange, purple,

\* See Chap. iv., Cochineal.

and green, are compounds severally from the simple colours, as red and blue—purple; yellow and blue—green; yellow and red—orange. The combinations of these produce other colours and shades, and to obtain these, no knowledge is so necessary as that of the chemist. There are colours, also, in nature which may be called for distinction *inorganic*, because they may be seen in various phenomena, though inapplicable for the same purposes as organic matter—as the colours we see caused by the action of the rays of light upon water, ice, and other transparent bodies; and in the colours of the rainbow.

Name some of the chief organic colours used in the arts of life.

Indigo, a beautiful blue, used by dyers, the product of a small shrub. Madder, the root of another plant, largely employed for a red dye, cultivated in France, Holland, and the Levant. There is a yellow obtained from the bark of a kind of oak, another from the yellow-wood tree of Africa, called fustic; the roots of turmeric, carrot, and rhubarb plants, and the petals of saffron, a native of this country, all yield yellows. Gamboge is another yellow; and logwood bark produces purple, &c.

From what part of the shrub is Indigo obtained?

From the leaves; the colour is produced by soaking them some hours in water, in large vessels constructed for the purpose; the sediment of the blue liquor drawn from them is afterwards dried and sold in the form of small grains. These grains are used in dyeing stuffs, &c. For the painter, they are diluted and worked up into small cakes with gum water, or mixed with oil.

In what countries is indigo cultivated?

It is a native of the Indies and South America, where its cultivation affords employment to a great many people. It also grows wild in parts of Palestine; and is much cultivated both in Syria and Egypt.

Has indigo been long known?

A substance was known to the ancients, which greatly resembled indigo; this is supposed to have been woad, a blue dye extracted from a plant resembling indigo in all its properties except its brilliancy of colour. The culture and preparation of indigo were known to the Oriental



nations long before it was introduced into Europe. The inhabitants of ancient Britain painted their bodies with the blue dye which they obtained from woad.

*Culture, cultivation, act of planting and rearing.*

What is Gamboge ?

The concrete resinous juice of a species of gum-tree growing in Cambodia, and other parts of the Indies. It is brought over in large cakes or rolls of a yellowish brown colour outside, and inside of a deep yellow or orange, which changes to a pale bright yellow on being moistened.

What are the uses of gamboge ?

Dissolved in water, it forms a beautiful and useful colour for the painter. It is also used in medicine. Gamboge is soluble in either water or spirits of wine. Mixed with a blue colour it forms green, in various shades, according to the different quantities in which either colour is mixed.

What is Logwood ?

The wood of a tree which grows in South America and the West Indies. It is brought over to Europe in great quantities, and employed in dyeing purple and the finest blacks.

Name other blue dyes.

There are other blues prepared from minerals, &c., having a brighter colour and various shades—as Prussian blue, prepared from green vitriol or copperas,\* which is a sulphate of iron; ultramarine, from lapis-lazuli, a blue or azure coloured stone, and also artificially from chemical preparation of some particular metals by the action of heat. Cobalt is a blue obtained from a brittle metal of that name, found chiefly combined with arsenic. It is used in colouring porcelain and blue wares.

What is the origin of the name ?

The German miners named it thus from *Kobold*, the demon of mines, because they considered that its presence denoted the absence of the more valuable metals.

What is a Demon ?

An evil spirit. It here means one of those imaginary beings, who, in the ignorance and superstition of former

\* See Chap. ix., article Copperas.

times, were supposed to preside over the destinies of men. Of these, there were both good and bad, and scarcely any element was without its supposed supernatural inhabitant or deity.

*Supernatural*, beyond the qualities of nature, not appearing in a natural condition.

How ancient is the art of colouring ?

It must have been one of the earliest, for it is spoken of in the Scripture, in the time of the patriarchs ; Joseph had his coat of "many colours;" and it was certainly practised at the same epoch by the Egyptians, if not previously. The Hebrews, in the time of Moses, prepared curtains of "blue, and purple, and scarlet," for the tabernacle. The Chinese possessed the art in great perfection; the Phœnicians of Tyre were famous for a beautiful colour called the "Tyrian purple," which has never been surpassed, and which their merchants imported to distant lands. The Greeks and Romans were likewise skilled in it, at a later period.

What is Tar ?

A coarse, resinous liquor, issuing from the wood and bark of pine or fir-trees ; it is in fact the oily juices of the sap thickened and coloured by the heat of the sun or by age ; it is extracted for use by burning the wood of the trees. Tar is exported in great quantities from Norway, Sweden, and other countries where the fir-tree grows.

What are its uses ?

It is applied to the sides of ships and boats, and their rigging, to preserve them from the effects of the weather ; instead of paint, for palings, &c. ; and sometimes used in medicine. A kind of tar is also drawn from coal, by the process of distillation, called *mineral* tar. Mineral tar is also found native in some parts of the earth.

What is Pitch ?

A kind of juice or gum, drawn from unctuous woods, chiefly those of the pine and fir ; the best is brought, like tar, from Norway and Sweden ; it is used for nearly the same purposes as tar, in shipping, medicine, and various other arts. Pitch is properly a juice of the wild pine, or pitch tree ; it is of a glossy black colour, dry, brittle, and less bitter and pungent than the liquid tar.

### What is Camphor ?

A vegetable substance, chiefly procured from a kind of laurel (*Laurus Camphora*), growing in Borneo, Japan, and many East Indian islands; it is also produced from other plants and shrubs in different quantities. The root of the cinnamon-tree produces a matter which has the smell, and many of the properties, of camphor; and some of the aromatic herbs, as thyme, &c., afford it, though in very small quantities.

### How and from what part of the tree is it taken ?

All parts of the tree are impregnated with camphor; but it is principally extracted from the roots and trunk, by distillation; it is white, and of a crystal form; its odour is extremely fragrant. In this state it is called *rough* camphor, and is thus exported to Europe. The Greeks and Romans do not appear to have been acquainted with this valuable drug, and we are indebted to the Arabians for a knowledge of it.

### What are the properties and uses of camphor ?

Camphor is neither a salt nor a gum, and therefore it will not dissolve in water; nor a resin, as it does not yield, by distillation, either phlegm, or oil, or an acid spirit, as all resins do. It totally vanishes or evaporates in the open air; and in spirits of wine, &c., it entirely dissolves. It is a firm, dry, crystal matter, with a hot, sharp, aromatic taste. It is so inflammable as to burn and preserve its flame in water.

### For what is camphor used ?

For various purposes—as in fireworks, &c.; it is an excellent preservative of animal and vegetable bodies, as it resists worms and other insects. In the courts of Eastern princes it is burnt at night with wax. Its principal use with us is in medicine and the arts.

*Phlegm*, a watery humour. *Preservative*, preventing decay.

### What is Musk ?

A dry, friable substance, of a dark colour, taken from a little bag under the belly of a small animal, about the size of a common goat; the musk animal is a native of the Indies, Tonquin, and China. It inhabits the woods and forests, where the natives hunt it down. Musk is so strong a perfume as to be agreeable only in the smallest

quantities, or when mingled with some other scent ; it is used in perfumery, &c.

Is there not another animal which produces a similar scent ?

Yes ; an animal of Arabian origin produces an odoriferous substance called civet, from which it takes its name of civet cat ; there are several species of this animal which produce it, but it is from the civet cat that it is most commonly taken. Civets are found in all the warm parts of Asia and Africa, in Madagascar, and the East Indian islands. It was formerly in high esteem in Europe, but is at present very little used, except to increase the power of other perfumes.

What is Myrrh ?

A kind of gum resin, issuing from the trunk of a tree growing in Arabia, Egypt, and Abyssinia ; it flows either naturally, or by incision ; and is sent to us in small lumps of a reddish brown or yellow colour. Its smell is strong, but not disagreeable. Our myrrh is the very same drug that was used by the ancients under the above name. Its chief use now is in medicine. The ancient Egyptians employed it as an ingredient in the embalming of dead bodies.

*Embalming*, preserving the bodies of the dead from decaying or putrefying, by impregnating them with aromatics and other substances which resist putrefaction.

Where is Abyssinia ?

Abyssinia is a large kingdom situated in Eastern Africa.

What is Frankincense ?

An odoriferous aromatic gum or resin, which distils, in the heat of summer, from incisions made in the bark of the tree which produces it ; notwithstanding the great use of the gum both in ancient religion and modern medicine, authors have been much divided in opinion with regard to the kind of tree which produces it, or the exact place of its growth ; it is supposed to be a species of turpentine-tree.

For what was it formerly used ?

The ancients burnt it in their temples as a perfume, and to do honour to the divinities that were worshipped

in them ; it appears to have been applied to the same purposes by people of all religions. Myrrh and frankincense were reckoned by the eastern nations amongst their most costly and valuable perfumes. We are informed by St. Matthew, in the New Testament, that the wise men who came to Bethlehem to worship our Saviour at his birth, brought gifts of gold, frankincense, and myrrh. Many of the primitive Christians were put to death because they would not offer incense to idols. In the Romish Church they still retain the use of incense in many of their ceremonies. It is now used in medicine.

*Primitive, early. Incense, a thing burnt ; perfumes burnt in honour of any one.*

- What is the appearance of frankincense ?

It is generally imported in white or yellowish pieces, or drops, which possess a bitter, disagreeable taste ; it flames and burns when set alight, with a strong and not unpleasant smell. That brought from the Indies is inferior to the Arabian, and inclines to a reddish colour. The common frankincense (supposed to be the produce of the pine that yields turpentine), is softer, more resinous, and of less value than the former.

What is Turpentine ?

The resinous juice of many trees, as the pine, &c. ; it is, in fact, the juice that renders them evergreen, and which, when over-abundant, bursts their bark and oozes out. Common turpentine is that procured by incisions from the wild pine ; there are several different kinds of turpentine procured from various resinous trees, which are named from the places whence they are brought, as Venice turpentine, &c. ; some are of use in medicine, and most of them in making different kinds of varnishes, for preserving and beautifying boxes, paintings, &c., and used in the various arts.

*Ooze, to flow out.*

Is there not a tree more particularly designated the Turpentine-tree ?

Yes ; the terebinth or turpentine-tree of Palestine and the East. It is one of their most common forest trees, and is regarded with respect and distinction similar to that acquired by the oak in our own northern latitude.

What part of it produces the Gum ?

The gum, or rather the resin, distils from the trunk. It is called Cyprus or Chian turpentine, much of it being brought from the isles of Cyprus and Scio, or Chios, and is procured by incision, about the month of July. This turpentine, owing to its scarcity (each tree seldom yielding over two or three pounds), as well as its superior quality, is very costly.

*Incision, cutting. Costly, rich, rare, expensive.*

## CHAPTER XVI.

**BRICKS, MORTAR, GRANITE, SLATE, LIMESTONE, OR CALCAREOUS ROCKS, STEEL, EARTHS, VOLCANOES, AND EARTHQUAKES.**

Of what are Bricks composed ?

Of clay, mingled with sand or ashes, and dried by the heat of the sun, or burnt in kilns ; their colour varies with the proportion of ashes or sand employed in the mixture, and with the different degrees of heat to which they are subjected in drying. In the East, bricks were baked in the sun ; the Romans used them crude, only laying them to dry in the air for a long space of time.

*Crude, in the rough, unbaked state, just as they were formed.*

How long have bricks been in use for building ?

Bricks appear to be very ancient, both from the account of them in the Holy Scriptures, and from the remains which have been found ; the Tower of Babel and the walls of Babylon were built of them. They were in early use among the Egyptians, as appears from the history of the Jews before their deliverance by Moses. In the book of Exodus, we are told that this captive people were compelled to make bricks for that nation. The Romans under their first kings built with massive square stones ; but towards the end of the republic they began to use brick, borrowing the practice from the Greeks ; and the greatest and most durable buildings of the succeeding emperors were composed of them, as the Pantheon, &c.

*Massive, thick, heavy.*

By whom was the Tower of Babel erected, and why ?

By the descendants of Noah's three sons, Shem, Ham, and Japhet; they were extremely numerous, and dwelt in the land of Shinar. Becoming ambitious of distinguishing themselves, they set about building a tower whose summit might reach to heaven. Shinar was the original name of the country about Babylon.

*Descendants*, those come or descended from a particular person or family.

What remarkable event followed their foolish pride?

The Almighty suddenly frustrated their purpose, by confusing their language and causing them all to express their words by different sounds; from hence arose the numbers of different languages spoken by the nations of the earth; and thus what they imagined would be a monument of glory, was made an awful memento of their pride and folly.

*Frustrated*, prevented, destroyed. *Monument*, anything by which the memory of persons or things is preserved. *Memento*, a hint to awaken the memory of anything,

What good effect did this event produce?

God, who at all times can bring good out of evil, by this means caused the other parts of the earth to be peopled; for this visitation having effectually broken up their scheme, they emigrated in parties, and dispersed themselves over different parts of the world.

*Scheme*, plan, intention. *Emigrated*, wandered. *Dispersed*, separated.

Where was Babylon?

This celebrated city, so often mentioned in Holy Writ (and remarkable for the minuteness with which its destruction was foretold by the prophets), was the capital of the Assyrian Empire, and situated on the river Euphrates. After the destruction of Nineveh, the ancient capital of this empire, Babylon became the most famous city of the East.

*Minuteness*, particularity.

What is meant by the Assyrian Empire?

The country of Assyria, in Asia.

For what was this city particularly celebrated?

For its hanging gardens, palaces, temples, and walls, the latter of which are said to have been three hundred

and fifty feet high, and so broad that six chariots could go abreast upon them. The city was so strongly fortified, both by nature and art, as to be thought impregnable.

*Fortified*, defended. *Impregnable*, incapable of being taken or destroyed by an enemy.

By whom was it destroyed, and when ?

By Cyrus, 538 years before the birth of Christ, just fifty years after Nebuchadnezzar had destroyed the city of Jerusalem and the temple.

Who was Cyrus ?

The founder of the Persian empire.

Who was Nebuchadnezzar ?

The King of Babylon.

What was the Pantheon ?

The word pantheon means a temple of a circular form which was dedicated to all the gods, or all the saints. That of all others the most celebrated, is the Pantheon of ancient Rome, and its remains are the most perfect amongst the wonders of that city at the present day.

*Circular*, having the form of a circle, round. *Pantheon*, is derived from a Greek word, signifying all the gods.

By whom was it built ?

By Agrippa, the consul of Rome, twenty-five years before Christ ; and dedicated by him to Jupiter ; the name Pantheon was given on account of the great number of statues of the gods ranged in niches all round it ; and because it was built in a circular form to represent heaven, the residence of the gods.

Into what was it afterwards converted ?

Into a church, by Pope Boniface the Fourth, who dedicated it to the Virgin and all the Martyrs, under the title of " Our Lady of the Rotunda." Agrippa likewise built the Pantheon at Athens, which was but little inferior to that of Rome. The Greek Christians afterwards converted it into a church, dedicating it to the Virgin ; but the Turks, when they subdued Greece, changed it into a mosque.

*Dedicated*, appropriated to a particular person, or purpose, or thing, &c. *Residence*, dwelling, habitation. *Martyr*, one who is put to death for the cause of religion or virtue. *Mosque*, a Mohammedan temple.

What is understood by a Consul ?



The chief magistrate of the Roman republic or commonwealth. After the Romans had expelled their kings, they were governed by two consuls ; they were established in the year of Rome 245. The consuls were the head of the senate : they commanded the armies of the republic, and judged all the differences between the citizens ; they held their office for the space of a year ; at the end of which new ones were elected. Consuls were even continued under the Emperors after the republic was destroyed ; but it was little more than an honorary title, and at last became totally abolished.

*Expelled*, turned out. *Abolished*, no longer in existence.

To what is the term consul applied at the present time ?

To an officer established by a commission from kings or other princes, in the ports and factories of the Levant, the coast of Africa, and other foreign countries of any considerable trade, to facilitate and despatch business, protect the merchants of their nation, &c.

*Commission*, a trust imposed, command, authority. *Factories*, places where things are manufactured. *Facilitate*, to render easy.

What is meant by the Senate ?

An assembly or council of senators, that is, of the principal inhabitants of a state, who have a share in the government.

Explain the term Pope.

By Pope is meant the father or head of the Roman Catholic Church, who governs all affairs relating to its clergy and members.

What is meant by the Virgin ?

Mary, the mother of our Saviour, who is styled by way of eminence the Holy Virgin, and to whom the Roman Catholics pay divine worship.

*Eminence*, distinction.

What is a Saint ?

A person remarkable for the piety and holiness of his life ; in the Romish Church, it means holy persons canonised after death by the Pope, and prayed to by the members of that church.

*Canonised*, elevated to the rank of a saint.

Agrippa is described to have dedicated the Pantheon at Rome to Jupiter ; who was he ?

The principal deity of the pagan world.

What is used to cement bricks firmly together?

Mortar, a composition of lime, sand, and stone, &c., mixed up with water; the ancients had a kind of mortar so very hard and binding, that even to this day, it is next to impossible to separate the parts of some of their buildings; it is said that the lime which they used in their mortar was burnt from the hardest stones, or often from fragments of marble.

What is Granite?

A rock which has been formed by the union of three different minerals in a state of fusion; these on cooling, have crystallised and become distinct from each other in the mass. It is remarkable for the beauty of its colours, its hardness and durability. There are granites of many different colours, as red or rose-coloured, grey, green, variegated, &c.

*Fusion*, a melted state. *Mass*, a body, lump, substance.

What form does it bear?

Granite does not, like marble, form one extensive mass, but remains in separate and large fragments, rudely compacted together; besides the three minerals of which it is composed, particles of other stones, or metallic earths, are often accidentally mixed with it; hence it is called granite from its granulous structure.

*Compacted*, joined together. *Granulous*, consisting of small grains.

Where is granite found?

Granite occurs in all the larger mountain ranges, and in isolated masses in every country; not being a stratified rock, and being excessively hard, it is difficult to get it out in manageable masses. In Arabia Petræa, the whole country abounds in masses of different granites.

*Isolated*, alone, separated, detached. *Stratified*, consisting of strata or beds.

What mode is usually employed in this country in obtaining it?

Blasting, or blowing up with gunpowder; the force of which detaches pieces from the rock, which are hewn roughly into forms on the spot by a small pickaxe. Granite is also quarried by cutting a deep line some yards long, and placing strong iron wedges at equal distances

along this line; these wedges are struck in succession with heavy hammers, till the mass splits down. Another method of detaching masses of rock is by driving wooden wedges into a deep artificial or natural crack, or fissure; the wedges are then wetted, and the wood swelling bursts the rock asunder.

*Quarried*, from to *quarry*, a term used for the getting of stone, &c.,—derived from *quarry*, a stone-mine, or place where they dig stone. *Asunder*, in pieces. *Detach*, to separate.

For what is this rock used?

For public buildings, as bridges, markets, churches, &c. London and Waterloo Bridges, Covent Garden and Hungerford Markets, and the York Column in Pall Mall, are instances of its use in London. The ancient temples and other buildings in Egypt, Asia, and Italy, were built with different-coloured granites, especially the beautiful Oriental red granite.

What is Slate?

The common name for a very soft, bluish, fossil stone, dug out of a quarry, and easily cut or split into thin plates,—a property which renders it invaluable for a variety of purposes.

*Invaluable*, extremely precious and useful.

For what is it used?

Slate has superseded the use of lead for covering roofs, even of the largest buildings; being lighter and more durable, it is preferable to tile: it is also employed for pavement, slabs to form cisterns, shelves for dairies, and other purposes, on account of its strength, coolness, and the ease with which it can be cleaned, the latter quality renders it also of great value in the business of education, as a cheap substitute for paper. The ancients were unacquainted with the use of slate.

Where are the principal slate quarries in Britain?

In Wales, Cumberland, and various parts of Scotland. It is taken out in table-like masses, by means of large wedges, and is then subdivided by smaller ones to the required thickness.

*Subdivided*, divided again.

What other kinds of Stone are used in building?

Limestone, or the calcareous rocks of the geologist, of

which there are many varieties. In our own country, the Portland stone (so called from its principal quarries being in Portland, Island, Dorsetshire) holds the first rank, and is that most used in London for buildings, and for the ornamental parts of edifices. It is easily sawn and worked when first quarried, and afterwards hardens by exposure to the air. Some of the coarser marbles, also, are used for building.

*Calcareous*, partaking of the nature of calx or lime,—a term formerly employed to describe chalk, marble, and all other combinations of lime with carbonic acid. *Geologist*, one who studies the science of geology.

Of what do Calcareous Earths or Stones consist?

Calcareous earths, stones, or rocks, consist of lime, or pure calcareous earth, carbonic acid, and water.

What is Quick-Lime?

Limestone deprived of its carbonic acid and water by being burnt in a kiln. It is a brittle, white, earthy substance.

How are these stones worked?

To whatever purpose the stones are to be applied, the larger blocks obtained from the quarry must be cut into smaller and more manageable pieces by sawing; the saw used is a long blade of steel, without teeth, fixed in a heavy wooden frame. These huge saws are worked by one or two men, who sit in watch-boxes to shelter them from the weather; a barrel or tub filled with water is placed so as to drip constantly into the cut, to facilitate the motion of the saw, and keep it cool, so as to prevent its losing its temper.

*Huge*, very large. *Temper*, sharpness, hardness; in speaking of metals it signifies the state to which they are reduced, especially with regard to their hardness.

What is Steel?

Iron, combined with carbon; called in chemistry carburet of iron. It is formed usually by being kept at red heat in a furnace for several days, with charcoal laid in layers with the bars of iron.

Is not steel of extensive use?

Yes; for making of knives, swords, and all kinds of instruments and edge-tools for domestic purposes and in the arts, from the ponderous pit-saw to the finest lancet.

It is more ductile than iron; and a finer wire may be drawn from it than from any other metal. The excellence of edge-tools depends upon the temper given them by heat.

*Ponderous, heavy, large.*

You say that a geologist is one who studies Geology; what is meant by this term?

A science which enables us to read, in the unerring language of nature, the changes which have taken place on the surface of the earth, in its structure and minerals. It describes the strata and materials which appear to have been deposited at remote intervals of time, and during progressive states of vegetable and animal organisation, and searches into the causes which have occasioned its present features.

*Unerring, true, never-failing. Remote, distant, far apart, Interval, space, time between. Progressive, going onwards. Organisation, formation or structure of bodies.*

What are Strata?

Level layers of rocks and other substances of which the whole earth seems to be composed. These rocks are found lying one above another in regular order—a rock of one kind covering another species of rock, this a third, and so on. These rocks and substances are divided into five classes or formations.

Describe them.

The Primitive, or lowest formations, are supposed to have been formed in the chaotic state of the earth, because they have no trace of organised beings or petrifications; they are chiefly composed of siliceous and argillaceous earths, as granite, slate, &c.—Transition rocks, supposed to have been formed during the transition of the earth into a habitable state, are the next; they differ from the primitive in containing the remains of marine animals;—the Stratified rocks, containing the remains of animals and vegetables, and consequently formed after their creation;—and the Alluvial formations, constituted of parts of previous rocks separated by water, air, &c., and deposited in beds.

*Petrification, the state of being turned to stone. Siliceous, compounded of flint. Transition, change from one state to another. Argil-*

*laceous*, clayey, consisting of clay. *Chaotic*, resembling chaos, confused. *Chaos*, confusion, a mingled heap; a term used in speaking of the world while yet without form; a Greek word, signifying a confused mass. *Alluvial*, that which has been removed by the action of water to another place.

Of what are these last compounded?

The alluvial formations are composed of sand, gravel, loam, clay, turf, &c., and contain plants, roots, moss, bones, petrified wood, and skeletons of animals. The fifth class of formations are called Volcanic, because composed of minerals thrown from the crater of a volcano; they consist of pumice stones, lava, &c.

*Crater*, the mouth or opening of a volcano. *Petrified*, hardened into stone.

You mentioned Siliceous and Argillaceous earths: is not, then, the earthy covering on our globe of one common character?

No; by earth is understood a combination of many distinct bodies. Chemists, by separating earths from each other, and from foreign matters connected with them, have discovered eight or nine primitive earths, which will not dissolve either in fire or water, and are incapable of decomposition.

*Chemist*, one who understands the science of chemistry. *Decomposition*, decay, separation.

Describe a few of the principal Simple or Primitive earths.

Of flint or silex, lime or calcareous earth, and clay or argil, in various degrees of combination, the greatest parts of the mountains and plains, and the whole of what we commonly understand by soil, mould, earth, &c., are composed. These, however, though forming the largest proportion of the solid portions of the world, are constantly mixed with foreign matters, as metals (particularly iron) and acids (as carbonic acid) in immense quantities.

What are the properties of Flint?

Silex, or pure flint, will not dissolve in water, nor can it be melted by itself in any heat; but combined with alkalies, as soda or potash, it forms glass: it is the principal ingredient in stones, crystals, sand, and most of the precious stones.

What are the chief uses of Silex or Flint?

It is the **most** durable article in the gravel state, for the formation of roads; a necessary ingredient in earthenware, porcelain, and cements; the basis of glass and all vitreous substances; and a useful article for many different utensils and furnaces. The making of pastes or artificial gems is a branch of the art of glass-making; the basis used is a very hard and pure silex.

*Basis*, that part of any mixture of which it is the ground or base; the first principle or element of a thing or body, &c.

Describe the properties of Lime.

It is of a white colour, and possesses a hot, caustic taste. It forms peculiar salts with acids, changes vegetable blues to a green, will not fuse, gives out a quantity of caloric when sprinkled with water, and absorbs carbonic acid when exposed to the common air. Lime is very useful in the arts and manufactures, in medicine, &c. The farmers use it as manure.

*Caustic*, burning, hot; a term applied to substances which eat away and burn anything or part to which they are laid.

In what state is lime found in nature?

Never native, but combined with other substances; generally with an acid, and most plentifully with carbonic acid, as in chalk, marble, &c. It is also found in vegetables, and is the basis of animal bones: it likewise occurs in the water of the ocean, and in that of all springs and rivers. The method of procuring *carbonate of lime*, whether from chalk, marble, limestone, oyster-shell, &c., has been already described in a former chapter.

What are the properties of Clay?

Argil, or pure clay, called also *alumine*, from its being the basis of alum, is soft to the touch, adhesive, and emits a peculiar odour when moistened; forms a paste with water, and hardens in the fire. Its uses are so various and important, that it would have been almost impossible for man to have attained his present degree of civilisation if this earth had not been given him by nature in such abundance. Its uses have already been described in the arts of brick-making, pottery, &c. Besides these three principal primitive earths, there are others, having several properties in common, yet each possessing its different

and specific properties, and evidently designed for different and distinct purposes of utility.

*Specific*, belonging to its particular species; the character belonging to that species. *Utility*, usefulness.

What is a Volcano?

An opening in the earth, or in a mountain, from which are thrown out smoke, flames, stones, ashes, and melted lava. Beneath the outer crust of the earth inflammable materials appear to exist, which different causes excite into combustion. Volcanoes are supposed to owe their origin to the metals and minerals which form the bases of earths and alkalies; and which, when ignited, expand by the access of water, shake the rocky foundation,—and sometimes, bursting through, produce all the destructive effects of earthquakes. They break forth under the sea, as well as the land, and throw up mountains which rise above the level of the water.

Are there many volcanoes?

There are upwards of one hundred and fifty known volcanoes, three famous ones in Europe; Etna in Sicily, Vesuvius in Italy, and Hecla in Iceland. In America there are numbers; the most noted are Cotopaxi, near Quito, and Popocatepetl in Mexico.

Are there not traces of former volcanoes in Europe?

Many districts show their former existence; and part of Bath stands on the crater of an exhausted volcano in our own country. Spain, Portugal, and France, have marks of extinct volcanoes; and near Naples there are many remains. Many islands are entirely of volcanic origin; and many disarranged strata appear to have arisen from explosions whose combustible materials are now exhausted.

*Exhausted*, worn out, finished. *Volcanic*, partaking of the nature of a volcano. *Origin*, the beginning, first existence.

What are Earthquakes?

Shakings or vibrations of the ground, sometimes accompanied by rents, and shakings of the surface, so as to overthrow buildings, and swallow up towns and tracts of country. They are attended with a terrible noise, like thunder, and sometimes with an eruption of fire or water, or else smoke or winds.

*Eruption*, an issuing or breaking forth with violence.



What is supposed to cause them?

An electrical action between the atmosphere and some deep sub-strata, which, disturbing the roofs of subterranean caverns, and causing them to give way, produces the sinking in of the ground. Many hot countries, where much electrical disturbance takes place, are very subject to them : earthquakes always precede volcanic eruptions ; an open volcano, also, probably diminishes the force of earthquakes, by the vent which it affords.

Name some of the most remarkable earthquakes.

At different times the most terrific effects have arisen from earthquakes. Towns and cities have been swallowed up, and thousands of people destroyed by them. The eruption of Vesuvius in A.D. 49, buried the cities of Herculaneum, Pompeii, and others, under the flood of boiling lava, &c., which issued from its crater or summit. Thus they remained, till discovered a few years back, when the rubbish and soil was removed, and streets, houses, manuscripts, bread, fruit, grain, medicines, all in a state of preservation, were found just as they were left by the inhabitants at the time of the eruption. The island of Jamaica is remarkable for the earthquakes which frequently happen there ; and also the city of Lisbon, in Portugal.

*Subterranean*, underground. *Precede*, to go before. *Vent*, opening. *Terrific*, full of terror, dreadful.

Where is Jamaica situated ?

In the West Indies,—a large group of fertile islands which lie between the continents of North and South America. Jamaica is the principal one of those which belong to the English.

Name some of the islands that have been formed by volcanic agency ?

Teneriffe, Iceland, Sicily, St. Helena, part of Sumatra, Java, Japan, and the Sandwich Isles have been heaved up from the depths of the ocean by these subterranean fires. These islands have remained, but there are records of others which have thus appeared for a time, and again sunk.

## CHAPTER XVII.

## ARCHITECTURE, SCULPTURE, USE OF MONEY, NAVIGATION.

What is meant by Architecture ?

The art of building or erecting edifices fit for the habitation of man, to defend him from the weather, and for his domestic comfort and convenience ; for devotion, trade, and other purposes, and for the use of civilised life in every capacity. The word is from a Greek one, denoting the chief maker or fabricator.

*Capacity, state, condition.*

Is not this an art of great antiquity ?

It is almost as ancient as human society ; the changes of the seasons first led men to build themselves huts or cabins to retire into ; in process of time their manner of building gradually improved, and habitations were constructed of more stately forms and elegant proportions, and greater skill and variety were displayed in their ornaments. Hence arose the Five Orders or manners of building.

Of what were the first huts composed ?

Probably of the branches of trees driven into the ground, and covered with mud and stubble : at length, growing more expert, they placed trunks of trees upright, and laid others across to sustain the outer coverings ; from this they took the hint of a more regular architecture, and built edifices of brick and stone ; the trunks of trees which supported their dwellings gave them a notion of pillars or columns, which they afterwards erected of more durable materials.

How is it among uncivilised tribes at this day ?

Some reside underground, having their dirty dwellings entirely closed during the winter months ; in warmer regions, they are built of stakes, leaves, and turf, in the shape of a soldier's tent. In Africa, their kraals or huts are constructed in this manner, but of a circular form, with a hole at the top to let out the smoke. In many of the South Sea Islands, the natives, when first discovered, had progressed still further, having learnt to elevate the roof

on poles, and to fill in the sides of their houses with boughs or rushes, mud or sods.

*Probably*, most likely, not certain. *Edifice*, a building. *Notion*, idea. *Durable*, hard, lasting.

What people are represented by the ancient writers as carrying the art of building to a greater state of perfection?

The inhabitants of the city of Tyre, to whom Solomon had recourse for workmen to build the Temple. Isaiah, in his twenty-ninth chapter, speaks of the Tyrians and Egyptians, as having brought it to a great degree of magnificence; which may be drawn from the various accounts handed down to us, and the remains of their obelisks, pyramids, &c.

What is an Obelisk?

A very high and slender four-sided pyramid, sometimes raised as an ornament in public places; and frequently covered with inscriptions and hieroglyphics.\* This kind of monument appears to be very ancient; they were first made use of to declare to posterity the principal precepts of philosophy; to mark the hours of the day by the shadows which they cast on the ground; and in after times, to immortalise the action of heroes, and perpetuate the memory of persons beloved.

*Inscription*, something written or engraved. *Hieroglyphic*, emblems of figures by which words were implied. They were used before the invention of alphabets. *Implied*, signified, denoted. *Posterity*, succeeding generations, descendants. *Immortalise*, to render immortal, — which means never dying; to perpetuate the memory of anything.

What is a Pyramid?

A solid, massive edifice, rising from a square, triangular, or other base, gradually diminishing in size till it ends in a point at top. Like the obelisk, they were sometimes erected to preserve the memory of singular events, or to transmit to future ages the glory and magnificence of princes; but oftener as funeral monuments and receptacles for the dead, particularly kings.

*Triangular*, three-sided, having three angles. *Diminishing*, growing smaller. *Receptacle*, the place in which a thing is deposited.

Is it known who were the erectors of these buildings?

\* See Chapter xviii.

No ; it is a curious fact that the Egyptian pyramids, so celebrated for their size and great antiquity, should have the time of their erection and the names of their founders wrapt in such complete mystery. All the different authors who have written concerning them, disagree in their accounts of those who built them, and nothing certain is known of their history.

*Founder*, one who caused it to be erected. *Mystery*, darkness, uncertainty.

What other nations excelled in the art of building ?

The Egyptians, from whom it passed to the Greeks and the Romans, from whom we derive it. Grecian architecture was in its highest glory under Pericles. Among the Romans, this art arrived at its greatest perfection under the Emperor Augustus. The five orders of ornamental architecture invented by the ancients, at different times, and on different occasions, are of Grecian and Italian origin. They are the Tuscan, the Doric, the Ionic, the Corinthian, and the Composite ; each possessing its peculiar form and beauty, and found in all the principal buildings of the Christian world.

*Christian*, not pagan ; the term applied to those who believe our Lord Jesus Christ to be the only true God and Saviour of the world. By pagan is understood a heathen—one who worships idols.

Who was Pericles ?

A celebrated Athenian statesman, orator, and general, who gained several victories over the Lacedemonians and other enemies of his country.

Are all the species of ornamental building confined to those nations already mentioned ?

By no means ; besides the Grecian and Roman orders, other civilised nations possess their separate styles ; as the Hindoos, Chinese, Moors, &c., and nothing can be more grand, harmonious, and picturesque than each of these in the beautiful specimens which are to be seen in their several countries. The Saxons, also, had a simple style of architecture, distinguished by semi-circular arches and massive plain columns ; these are still found in many of our oldest buildings ; the Normans, too, invented a beautiful kind called the Gothic, distinguished by its lightness and the number of its ornaments, and by its pointed

arches and pillars carved to imitate several combined together; the Gothic style is found in most of our old cathedrals.

*Hindoos*, inhabitants of Hindostan, in India. *Moors*, inhabitants of Morocco, a kingdom of Barbary, in Africa. *Harmonious*, corresponding in all its parts with equal beauty and elegance. *Picturesque*, like a picture. *Saxons*, inhabitants of Saxony, a kingdom of Germany. *Semi-circular*, only half circular, not a perfect circle.

Describe the orders of architecture.

The Tuscan (from Tuscany) is the most simple and devoid of ornament, and its columns or pillars are plain and massive. The Doric (from the Dorians, in Greece) is durable and noble in appearance, with fluted columns, and the upper parts without much ornament. The Ionic (from Ionia, in Greece) is neither so plain as the Doric, nor so richly elegant as the Corinthian, but distinguished from the first two orders by its columns or pillars being fluted instead of plain, and the upper part of it (called the capital) adorned by the figure of rams' horns carved on it. The Corinthian is very rich and delicate, with fluted pillars, and the top beautifully ornamented with leaves, &c. The invention of this order is ascribed to Callimachus, a Corinthian sculptor.

*Devoid*, free from, without a thing.

What is the Composite?

A compound of the others, chiefly of the Corinthian and Ionic; it is called also Roman or Italian. The proportions of all the orders vary slightly, but the distinguishing marks are the head or capital.

What is Sculpture?

The art of cutting or carving wood, stone, and other materials; and forming various figures or representations upon them. This art is of great antiquity; the sacred writings speak of it in many passages, as for instance, Laban's images, carried away by Rachel; the golden calf of the Israelites, &c. Sculpture as an art is probably more ancient than painting. The term signifies most strictly the carving of images or statues in stone, &c.

What country was the most highly celebrated for its sculpture?

Greece, which has produced many celebrated workers

in this art, of whom the most eminent were Phidias, an Athenian, the great master of this art, who lived in the time of Pericles, 480 years before Christ ; Lysippus, a native of Sicyon, near Corinth ; and Praxiteles, a native of Magna Grecia, besides a number of others.

What event proved fatal to this art ?

The death of Alexander the Great was followed by a visible decline in all the fine arts ; but the fatal blow to their existence was given by the success of the conquering Romans, who reduced Greece to a Roman province.

Was sculpture always performed in stone ?

No ; at first statues and other figures were formed of wood or baked clay, afterwards of stone, marble, and metals ; though these last were not brought to any degree of perfection till about three hundred years before Christ. The Greeks were famous for their works in ivory ; but the great master of the art of working statues in it was Phidias.

What progress did the Romans make in sculpture ?

Sculpture in all ages of their history, existed rather as a plant of foreign growth, partially cultivated by them, than as a native production of their own land. They collected, indeed, statues, gems, and some of the most exquisite samples of Grecian sculpture, and invited to their capital the yet remaining sculptors of Greece, by whose labours not only Rome itself was embellished, but also many of the cities of Asia Minor, Spain, and Gaul, then under the Roman dominion ; yet the taste for sculpture does not appear to have been cultivated in any measure corresponding with the advantages thus afforded them in the study of the best models of the art. The best works were produced by Greek artists, and chiefly Athenian, while the attempts of the Romans were unskillfully executed.

*Gaul*, the ancient name of France. *Model*, pattern.

Did it always continue thus ?

No ; from the time of the Emperor Constantine, sculpture, and the rest of the fine arts, gradually revived. While inspired, perhaps, with a taste for sculpture by means of the scattered remains of Grecian art, the Roman artists drew, at the same time, from their own resources,

and were by no means servile copyists of the sculptors of a former age.

Where was the first academy of the art formed?

At Florence, in 1350. At the close of the same century, sculpture was firmly established in Italy, and itinerant sculptors, not unskilful in their art, wandered from thence to Germany, France, and even to England. The most eminent master of the art was Michael Angelo, born in 1474, who was also a painter and architect; from his time, to the latter end of the last century, sculpture again gradually declined, but it revived under Canova, a native of Possagno, in the Venetian Alps. He was born in 1757. Besides the above mentioned, were a number of others of various degrees of talent, as well as some still living.

*Servile*, mean. *Itinerant*, wandering, unsettled.

When was the knowledge of sculpture introduced in England?

At the time of its conquest by the Romans; but the art appears to have been very rude and imperfect. From the time of the Norman invasion, and still further in the time of the Crusades, an improvement, however, began to show itself in British sculpture. But it is probable that most of our best architectural and sculptural works were executed by foreigners, members of those societies of wandering sculptors before mentioned.

*Invasion*, hostile entrance upon the rights or possessions of another. *Architectural*, belonging to architecture. *Sculptural*, belonging to sculpture.

In what reign does the art appear to have been much cultivated by Englishmen?

Under Edward the Third. It is well known that two Italian sculptors were employed in England during the sixteenth century. John of Padua, a pupil of Michael Angelo, was master of works to Henry the Eighth. In the reign of Charles the First, English sculptors flourished, although their works are of a very low order.

Were the sculptors of England in the last century natives or foreigners?

All those of any talent were foreigners, and the principal works were executed by Gibbons, Cibber, Steevens, De Vere, Bertocini, Roubiliac, &c.

With whom may the school of British sculptors be considered as commencing?

With Banks, born in 1738, and Bacon, born in 1740 ; these were in every respect English artists. But the most eminent worker in the art which this country has yet produced, was John Flaxman, born in 1755.

Name a few more in the last century.

Joseph Nollekens, born 1737 ; Richard Westmacott, 1775 ; and the eminent Francis Chantrey, undoubtedly the finest sculptor this country has produced, his works being unrivalled for grace, simplicity, and trueness to nature. Scotland also has had Robert Forrest and James Thorn, both full of genius and originality, and no mean proficient in this interesting art. All these flourished in the last century, and the commencement of the present, with others of lesser note. Our country also possesses many sculptors of superior genius still living ; and the beautiful specimens of art which have appeared during the last few years, promise the attainment of a high degree of excellence.

*Attainment*, that which is attained or acquired.

Give me a short account of this art in Germany and France.

As in the case of our own early history, many of the best works were executed by Italians. Germany appears to have made little progress in sculpture before the seventeenth century ; this country has, however, produced sculptors of some eminence, although it is more celebrated for its writers on the art, than for artists of eminence in its practice. In France, sculptors of some talent are mentioned as early as the sixteenth century. Girardon and Puget were the most celebrated artists of this period. In Spain, Spanish history gives a long list of native sculptors, from the commencement of the same century, but many of them are little known beyond their own country. Berruguete, a pupil of Michael Angelo, appears to have founded the first regular school of the art. Paul de Cespides, and, in the eighteenth century, Philip de Castro, were the most eminent among them.

When was the use of Money first introduced ?

It is not known with certainty ; there is, however, reason



to believe that both gold and silver were very early used as money in Egypt and Asia; it was afterwards introduced into Carthage and Greece; from whence it was brought to Rome; and from that city spread gradually westward through all the Roman dominions.

What was practised before that time?

Barter, or the exchange of one commodity for another, a custom long retained by uncivilised nations. In time, however, men discovered the necessity of something which would enable them to trade with greater facility; the first mention of money is in the time of Abraham, who, we are told in the Bible, paid "four hundred shekels of silver, current money with the merchant," for a burying place.

*Facility, ease. Current, generally received, passing from hand to hand.*

Where was Carthage?

Carthage, now Tunis, was a commercial city, situated on the northern coast of Africa, which long contended for the dominion of the Mediterranean with the Romans; but after three wars, it was taken and destroyed by the Roman general, Scipio Africanus, in the year 251 before Christ.

*Commercial, relating to commerce or trade.*

Of what substance was money usually made?

Metal was found to be well calculated for this purpose on account of its durability, its capability of being made of different weights and sizes; and because it was easily reduced to the same standard, or value, in all nations: a precious metal also was still better calculated for this purpose, because more portable. At different times and amongst various nations, however, other things have been substituted, as shells, wood, leather, paper, or even paste-board, on extraordinary occasions, in the scarcity of metal.

*Portable, easily carried from one place to another.*

Of what form was it generally made?

The form of money has been more various than its materials; the ancient Britons used as money, rings or bars of iron or tin; the Lacedemonians used iron bars quenched with vinegar. The money of most nations

usually bore an impression peculiar to themselves, as, for instance, the shekel of the Jews was marked with the golden pot of manna on one side, and Aaron's rod on the other; others with the figures of animals, &c.; in shape it was either round, irregular, or square.

Have the terms Money and Coin the same signification?

Not exactly; by money is understood any matters, whether metal, wood, leather, glass, horn, paper, fruits, shells, &c., which have currency as a medium in commerce. Coin is a particular species always made of metal, and struck according to a certain process called coining; it is not of equal antiquity with money. In fact, the very commodities themselves were the first monies, that is, were current one for another by way of exchange.

What is coin?

A piece of metal converted into money, by the impression of certain marks or figures thereon. The first coining of silver took place at Rome 269, and of gold 206 years before Christ: the Romans, after the commonwealth, stamped their coins with the image of the reigning emperor, a custom which was followed by most civilised nations. Coins were, and are, frequently struck in commemoration of a particular event or celebrated person.

When was the use of stamped coin introduced into Britain?

After the arrival of the Romans in this island, the natives imitated them, coining both gold and silver with the images of their kings stamped upon them; but the Romans, when they subdued the nation, suppressed also their coins, and obliged them to use their own; hence the number of Roman coins found among the relics of antiquity in this island.

*Suppressed*, put aside. *Relics*, remains. *Antiquity*, belonging to ancient times.

When were shillings first coined in England?

In the reign of Henry the Seventh, in 1505. The first coining of silver crowns and half-crowns took place in the time of Edward the Sixth. There were English crowns long before that period, but they were always of gold; but it was from the reign of Edward the Third that the

regular series of gold coinage commenced. Gold coins of various names were afterwards struck by our different English princes.

*Coinage*, the art or practice of coining money.

What does the first coined money in ancient Britain appear to have been?

Copper money; but after the arrival of the Saxons in England, scarcely any copper money was used for many centuries; nor was English authorised copper money general till 1672; copper money was first used in Scotland and Ireland in 1340.

*Authorised*, sanctioned, allowed.

Where is the British coinage performed?

At the Mint, near the Tower of London, where there is a corporation for it under that title. Formerly cities, towns, and even individuals, were allowed to coin copper money for the convenience of trade; but now the coining of all money is forbidden except at the Mint.

What is a Corporation?

A body of persons authorised by royal charter to have a common seal, one head officer or more, and members able, by their common consent, to grant or receive in law, anything within the compass of their charter.

What is meant by Navigation?

The art of constructing and building ships; and also the conducting and guiding of them through the seas. Some, perhaps, will consider the formation and use of the Ark as a first step towards the invention of this art; but it is an erroneous idea, because the direction and means for accomplishing this immense work were afforded by God, for the preservation of righteous Noah and his family. Besides, nothing is recorded of any means or of any necessity for its occupants *navigating* it to any particular place, or from one place to another; no intention of this sort is apparent, the ark being merely a vast shelter, rendered capable of floating on the water.

*Erroneous*, wrong, in error. *Apparent*, manifest, made to appear.

What probably gave the first idea of navigation?

Accident most likely showed that wood always floats; and on the fallen trunk of a tree, perhaps, some one ventured beyond his depth away from the land. The trunk

of a tree, hollowed out, for a more convenient position of the body (an idea which might be derived from a split reed, seen floating on the water), formed the canoe, usually found among uncivilised nations to this day. From this rude beginning, at a great interval of time, and a slow pace of improvement, the art has at length arrived at its present state of perfection.

What nation first applied this art to the purposes of trade?

The Phœnicians (especially those of Tyre, their capital city, and Sidon) were the first who adapted it to the purposes of commerce; and constructed vessels fit to make voyages to foreign countries; the poverty and narrowness of their land, as well as their vicinity to two or three good ports, and their natural genius for traffic, urging them to seek foreign supplies. We hear of them trading even as far as Britain; to Arabia, India, Persia, Greece, Africa, Spain, and several other countries.

*Vicinity*, nearness, neighbourhood. *Traffic*, trade, commerce.

Who were the Phœnicians?

The inhabitants of Phœnicia, a country of Syria, in Asia.

Which was the more ancient of the two cities, Tyre and Sidon?

Sidon,—having been built, as is supposed, soon after the Flood, by Sidon, the eldest son of Canaan. Tyre, about 25 miles to the south, was built about the year 1252 before Christ, by a colony from Sidon. The Phœnicians planted numerous colonies on the shores of the Mediterranean and the Atlantic, and diffused, to a great extent, among their uncivilised neighbours the arts and improvements of civilised life. One of their most celebrated colonies was that founded by them on the northern coast of Africa; and it was this colony who built the famous city of Carthage.

*Diffused*, spread abroad, scattered.

Did not Carthage afterwards become as flourishing as the parent city of Tyre?

In time, Carthage not only equalled Tyre itself, but surpassed it,—pursuing the course the Phœnicians had begun, and sending its merchant fleets through Hercules'.

Pillars (now the Straits of Gibraltar) along the western coast of Africa, and northwards, along the coast of Europe, visiting particularly Spain, Gaul, &c. They even undertook voyages, the sole object of which was to discover new countries and explore unknown seas. The Carthaginians appear to have been the first who undertook voyages solely for the sake of discoveries.

Were not both these celebrated cities destroyed?

Tyre, whose immense riches and power were the subject of many ancient histories, was destroyed by the Grecian Emperor Alexander the Great, and its navigation and commerce transferred by him to Alexandria, a new city which he meditated making the capital of Asia. Alexandria, in a short time, became the most important commercial city in the world. Thus arose navigation among the Egyptians; which was afterwards so successfully cultivated by them, that Tyre and Carthage (which last, as before mentioned, was subdued by the Romans) were quite forgotten.

*Transferred*, removed. *Capital*, chief or principal city, first in rank.

Who was Alexander the Great?

The son of Philip, King of Macedonia, in Greece; he was celebrated for his great ambition, and the number of his conquests; he overturned the Persian empire, and subdued many cities and provinces in the East.

Did not Alexandria undergo the same fate as Tyre and Carthage?

Egypt was at last reduced to a Roman province, after the battle of Actium, and its trade and navigation fell into the hands of the Emperor Augustus, in whose time Alexandria was little inferior to Rome; and the magazines of the capital of the world were supplied with merchandise from the capital of Egypt. Alexandria, however, at last underwent the fate of Tyre and Carthage, being surprised by the Saracens, who overran the northern parts of Africa; and though it still enjoyed a considerable portion of the commerce of the Christian merchants, it afterwards remained in a languishing condition: but still, even at this day, it is a place of considerable trade.

Who were the Saracens?

A Mohammedan nation, occupying a portion of what

is now called Arabia. They extended their conquests over great part of Asia and Spain. Their name is derived from the word Sara, a desert.

*Mohammedan*, having the religion of Mohammed.

What effect had the fall of the Roman empire on navigation?

The fall of Rome and its empire not only drew along with it its learning and the polite arts, but that of navigation; the barbarians, into whose hands it fell, contenting themselves with enjoying the spoils of those whom they had conquered, without seeking to follow their example in the cultivation of those arts and that learning which had rendered the Roman empire so famous.

What other nation distinguished itself about this period in the art of navigation?

The Saracens or Arabians, whose fleet now rode triumphant in the Mediterranean, and who had taken possession of Cyprus, Rhodes, and many of the Grecian islands, and extended their commerce and their discoveries in the East, far beyond the utmost knowledge of their ancestors.

What other circumstance also prevented commercial intercourse from ceasing altogether?

Constantinople, though often threatened by the fierce invaders, who spread desolation over Europe, was so fortunate as to escape their destructive rage. In this city, the knowledge of ancient arts and discoveries was preserved; and commerce, with the taste for elegance and the luxuries of foreign countries, continued to flourish there when it was almost extinct in every other part of Europe.

*Desolation, destruction, ruin.*

Did the citizens of Constantinople confine their trade to the islands of the Archipelago, or the adjacent coast of Asia?

No, they took a wider range; and, following the course which the ancients had marked out, imported the productions of the East Indies from Alexandria. When Egypt was torn from the Roman empire by the Arabians, the industry of the Greeks discovered a new channel by which the productions of India might be conveyed to Constantinople.

Did not the barbarians, after a while, turn their attention to navigation and commerce?

No sooner were those nations well settled in their new provinces—some in Gaul, as the Franks; others in Spain, as the Goths; and others in Italy, as the Lombards—than they began to learn the advantages of these arts, and the proper methods of managing them, from the people they had subdued; and that with so much success, that they even improved upon them, and set on foot new institutions for their advantage.

*Institutions, laws, regulations.*

To whom is usually ascribed the invention and use of banks, book-keeping, and exchange?

To the Lombards. Thus the people of Italy, and particularly those of Venice and Genoa, have the glory of restoring to Europe the advantages that had been destroyed by their own ravages.

What is Exchange?

The form or act of transferring property by bills or notes; the balance of the money of different nations; the thing given in return for something received.

Are not these called bills of exchange?

Yes. They originated from the necessity of an easier mode of transferring property; and to avoid the inconvenience of carrying about riches from place to place or on the person. It is to the Jews we owe the invention of the bill of exchange.

How so?

Persecuted, as they too often were, and obliged to leave a country at the shortest notice, and condemned by ferocious intolerance to a wandering life, it was found the easiest and safest mode of preserving their riches. For instance, on their expulsion from Portugal. Some historians date this custom from the beginning of the sixteenth century; others as far back as their expulsion from France by Philip Augustus.

Who were the Franks?

A nation of Germany who settled in Gaul, from whom it took the name of Franconia, now called France.

Who were the Goths?

An ancient people, who inhabited that part of Sweden

called Gothland ; and afterwards spread themselves over great part of Europe.

Who were the Lombards ?

The Lombards, or Longobardi, were, like the Franks, a nation of Germany ; who upon the decline of the Roman empire, invaded Italy, and, taking the city of Ravenna, erected a kingdom.

Whereabouts in Italy is Ravenna situated ?

It is the capital of Romagna, a province of Roman Italy : it is an ancient town, and the see of an archbishop.

*See*, the seat of episcopal power ; the diocese of a bishop. *Episcopal*, belonging to a bishop. *Archbishop*, a bishop of the first class ; one of the heads or fathers of the church, who overlooks the conduct of other bishops under his charge.

What was the origin of the city of Venice ?

In the Adriatic Sea were a great number of marshy islands, only separated by narrow channels, but those well screened and almost inaccessible, inhabited by a few fishermen. To these islands the people of Veneti (a part of Italy, situated along the coasts of the gulf), retired when Alaric, King of the Goths, ravaged Italy. These new islanders, little imagining that this was to be their fixed residence, did not, at first, think of forming themselves into one community, but each of the seventy-two islands continued a long while under its several masters, and formed a distinct commonwealth.

*Adriatic Sea*, a name given to the Gulf of Venice. *Commonwealth*, a republic, a government in which the supreme power is lodged in the people.

What circumstance caused them to unite ?

Their commerce becoming considerable enough to awaken the jealousy of their neighbours, they united in a body for their mutual protection : this union, first begun in the sixth century and completed in the eighth, laid the foundation of the future grandeur of the state of Venice. From the time of this union, fleets of their merchantmen sailed to all the ports of the Mediterranean ; and afterwards to those of Egypt, particularly to Cairo, a new city built by the Saracen princes, on the banks of the Nile, where they traded for spices, &c. The Venetians continued to increase their trade by sea and their conquests



on land till 1508, when a number of jealous princes conspired to their ruin; which was the more easily effected by the diminution of their East Indian commerce, of which the Portuguese and French had both obtained a share.

*Conspired*, united together against them.

What is the signification of Mediterranean ?

Inclosed within land, or remote from the ocean. It is more particularly used to signify the sea which flows between the continents of Europe and Africa.

Had not Venice a formidable rival in a neighbouring republic ?

Genoa, which had applied itself to navigation at the same time with Venice, and with equal success, was long its dangerous rival, disputed with it the empire of the sea; and shared with it the trade of Egypt, and other parts, both of the East and West. Jealousy soon broke out; and, the two republics coming to blows, there was almost continual war between them for three centuries: at length, towards the end of the fourteenth century, the strife was ended by the fatal battle of Chiozza; the Genoese, who till then had usually the advantage, lost all, and the Venetians, almost become desperate, at one decisive blow, beyond all expectation, secured the empire of the sea and their superiority in commerce.

*Decisive*, determined.

Where is Genoa situated ?

Towards the west of Italy. It was formerly a flourishing republic, but now a province of Sardinia.

What event likewise contributed to the more rapid progress and diffusion of navigation and commerce ?

The Crusades: for the Genoese, Pisans, and Venetians furnished the fleets which carried those vast armies, composed of all the nations of Europe, into Asia, upon this wild undertaking, and also supplied them with provisions and military stores. Other travellers, also, besides those whom religious zeal sent forth to visit Asia, ventured into remote countries, from the prospects of commercial advantage, or from motives of mere curiosity.

*Zeal*, devotion, enthusiasm.

Who were the Pisans?

Inhabitants of Pisa, an ancient town of Tuscany; it was once a great, independent republic, and is still adorned with noble edifices. Pisa has long been celebrated for its remarkable leaning tower. Tuscany is a beautiful and fruitful territory of Italy : its capital is Florence.

What were the Crusades?

Holy wars, or expeditions, undertaken by the Christians against the Turks and Saracens, to recover Palestine, between the years 1100 and 1400.

What causes led to these wars?

Many circumstances contributed to give rise to them : a mistaken devotion, the Pope and the priests preaching it as a point of conscience, and an expiation for crimes, even of the blackest dye ; it was thought reproachful to the Christians to suffer a country in which the Son of God had accomplished the redemption of mankind to be abandoned to the enemies of the Christian name, and that it was meritorious to revenge the injuries its professors had suffered under the Mohammedan yoke ; and frequently from a desire of visiting the scene of such memorable transactions, or an ambition to acquire martial renown and fame.

*Expiation*, the act of atoning for any crime. *Meritorious*, deserving reward. *Transactions*, events. *Martial*, warlike.

What badge or sign was worn by those who engaged in the Crusades?

They distinguished themselves by crosses of different colours, worn on their clothes, from which they took the name of Croisés, or Cross-bearers ; each nation wore different colours—for instance, the English had white crosses, the French red, and so on.

To what invention does the present art of navigation owe its rise?

To that of the mariner's compass, in the beginning of the fourteenth century ; and from this period may be dated the present perfection of this useful art.

You have given me an account of the restoration of navigation in Southern Europe : did not the inhabitants of the North also turn their attention to it?

Yes: about the same time, a new society of merchants was formed in the northern parts, which not only carried commerce to the greatest perfection it was capable of, till the discovery of the Indies, but also formed new codes of useful laws for its regulation.

*Codes*, books or writings setting forth certain laws or rules respecting particular subjects; books of civil laws.

Are navigation and commerce inseparably connected with each other?

It may be considered as a general maxim that their union is so intimate that the fall of one inevitably draws after it the other; and that they will always either flourish or decline together may be seen, by examining the reason of their passing successively from the Venetians, Genoese, &c., to the Portuguese and Spaniards, and from them to the English and Dutch.

*Marim*, rule. *Intimate*, close. *Inevitably*, without possibility of escape, unavoidably.

What invention has more than ever facilitated their progress?

That of steam-vessels. Great as had been the improvements in naval architecture, this has been the crowning point of all.

When were steam-vessels invented?

Between 1736 and 1795 various attempts were made to construct vessels which should be propelled by the power of a steam-engine. This engine, setting in motion a set of wheels or paddles at the ship's side, forces it onwards through contrary winds and currents with extraordinary rapidity.

*Propelled*, driven forward.

To whom is the honour of this invention due?

The Americans lay claim to the first successful attempt; but it is certain that the honour belongs to our own country, not only for the invention, but also for the practical application of the power of steam for navigating vessels. A Mr. Bell, of Scotland, really built the first practical steam-boat in Europe, and plied it on the river Clyde about 1811.

How was his invention received?

Ten years before his boat on the Clyde, he had pur-

chased a small French vessel, and fitted it up. With this he sailed from the Clyde, by the Land's End to London, and submitted his plans to government; which received them with indifference, considering them of no value. After this, he sent models of his boat to all the sovereigns of Europe, and to America.

What was the result?

The American government sent for him to assist the celebrated Fulton in constructing the first steam-boat in that country. It was on his return from this expedition that he established the boat on the Clyde, just mentioned, and named it the "Comet."

How did this affect the public?

Safety and success once ascertained, men of capital began to build boats with greater accommodation for passengers: and in 1813 the first steamer was established on the Thames from Gravesend to London. The first attempts, however, were confined to river navigation, the idea of going to sea being thought presumptuous.

*Capital*, in commerce, money, or property possessed.

When did Ocean-Steamers begin to be adopted?

In 1818 a *coast-steamer* sailed from Greenock to Belfast; and in 1821 Post-Office packets crossed between Holyhead and Dublin, London and Cork.

How did Steam Navigation progress in America?

The resolution and undaunted perseverance of Fulton had been crowned with complete success. His first trip was on the river Hudson; and by his efforts, these wonderful improvements in naval architecture were finally established. In 1819 a steamer crossed from Savannah to Liverpool,—the first oceanic-steamer that had sailed over the Atlantic.

When were ocean-steamers regularly established as a means of communication with foreign lands?

In 1838, between England and America. Since that period, oceanic-steamers have increased rapidly. Numbers sail to and fro, monthly, weekly, and daily, uniting us with neighbouring countries, with the Indies, Australia, Africa, &c. &c., spreading abroad a tide of commerce, knowledge, and civilisation.

## CHAPTER XVIII.

MUSIC, PAINTING, PHOTOGRAPHY, POETRY, ASTRONOMY, ARTS AND SCIENCES, ART OF WRITING, AND CHEMISTRY.

What are the earliest accounts of Musical Instruments on record?

The earliest accounts of music which we possess are to be found in the Bible, where the state of the world before the Flood is noticed. Tubal is said to have been "the father of them that play upon the harp and organ;" but it is not to be supposed that these instruments at all resembled the harp and organ of modern times. Musical instruments in very early times were employed to show honour to any person. In the times of David and Solomon, they were used in religious services; and music was certainly employed by the Jews on many other occasions, as at funerals and weddings, at harvest homes, and at festivals of all kinds.

*Modern*, opposed to ancient, at a later, or the present time. *Festival*, a rejoicing, a feast, a season dedicated to mirth.

What nation was particularly celebrated for musical talents?

The ancient Egyptians, who were so celebrated for their talents in music, that the distinguished philosophers of Greece braved many dangers, in order to study the science in Egypt; and this, at a period when the Egyptians were far from being in the same high state of civilisation as their forefathers had been in earlier times. The history and monuments of ancient Egypt have many accounts and representations of musical instruments, and recent remains of these have lately been discovered, so that we have ocular demonstration both of their existence and form.

*Civilisation*, freedom from barbarity, polish, politeness, possession of knowledge and the arts of life. *Ocular*, known or seen by the eye. *Demonstration*, the act of proving with certainty and without doubt.

In how many divisions may musical instruments be arranged?

There are three kinds, namely, *wind* instruments, as

the trumpet and the organ ;—*stringed* instruments, as the harp or lyre, violin, &c. ; and instruments of *concussion*, in which the sound is produced by striking a sonorous body, as for instance, the drum, bells, &c.

Which of these three kinds was the first invented ?

It is impossible, at the present day, to decide which, but it is most probable that instruments with strings were the last invented of the three kinds ; and it is most likely, that of those in which sound is produced by the application of wind, the trumpet or horn was first used. This instrument, in its rudest form, was ready fashioned to the hand of man ; the horn of a ram or an ox, or some of the larger kinds of sea-shells, were soon discovered to possess the power of producing sound, by being blown into through a small hole at the pointed end.

What improvement in this instrument would naturally follow ?

Mankind having discovered the property possessed by a hollow tube of producing a certain sound, soon found that the note varied according to the length and capacity of the tube. A much greater improvement then took place ; it was discovered that one tube answered the purpose of many, by boring holes in the course of its length, and various musical sounds were produced by stopping with the fingers certain of these holes. Most of our modern wind instruments are but improvements on the ancient inventions.

*Tube*, a pipe ; a long hollow body.

Was not Vocal Music used before the invention of Instrumental ?

*Vocal* music, namely, that produced by the human voice (so called to distinguish it from *instrumental*, that produced by instruments) was undoubtedly the first : for man had not only the various tones of his own voice to make his observations on, before any art or instrument was found out, but the various natural strains of birds to give him a lesson in improving and modulating the sounds of which it was capable.

*Modulating*, from modulate, to govern or form sound to a certain key or note.

To what circumstance did an ancient poet ascribe the invention of stringed instruments?

To the observation of the winds whistling in the hollow reeds. As for other kinds of instruments, there were so many occasions for cords or strings, that men were not long in observing their various sounds, which might give rise to stringed instruments. Those of concussion, as drums and cymbals, might result from the observation of the naturally hollow noise made by concave bodies when struck.

What are the most ancient stringed instruments?

The most ancient instruments of this kind, whose form is known, are those of the ancient Egyptians; among these the harp stands pre-eminent. One of the most celebrated representations of an Egyptian harp was drawn from a painting discovered in one of the caverns in the mountains of Egyptian Thebes, by some travellers: it is called the Theban harp, and has thirteen strings; its form is extremely elegant. This harp is supposed to be one of the kind in use before and at the time of Sesostriis. Remains of Egyptian harps of a more simple construction, with only four strings, have likewise been discovered. Among the monuments of ancient Rome, there are representations of stringed instruments resembling the harp, but nothing equal in beauty of form to the famous Egyptian harp already mentioned.

*Pre-eminent, above others.*

Who was Sesostriis?

A King of Egypt, who is said to have reigned some ages before the siege of Troy. He appears to have been celebrated for his conquests, and for the number of edifices he erected to perpetuate his fame.

*Perpetuate, to preserve from extinction; to continue the memory of a person or event.*

Where was Troy?

Troy, anciently called Ilium, was the capital of Troas, in Asia. It became famous for the ten years' siege it sustained from the Greeks, and for the history of this event being commemorated in the poems of Homer and Virgil.

Is not the harp an instrument of high antiquity in Great Britain?

Yes: it was a favourite instrument with our Saxon ancestors; the celebrated Alfred entered the Danish camp disguised as a harper, because the harpers passed through the midst of the enemy unmolested on account of their calling. The same deception was likewise practised by several Danish chiefs, in the camp of Athelstan, the Saxon.

What office was fulfilled by the Bards, or harpers of old?

They were the historians of the time, and handed down from generation to generation remarkable events: they related the deeds and lineage of their celebrated chiefs and princes, and rehearsed their praises. The harpers of Britain were formerly admitted to the banquets of kings and nobles: their employment was to sing or recite the achievements of their patrons, accompanying themselves on the harp. No nations have been more famous for their harps and harpers than the Welsh and Irish.

*Recite*, to repeat or chant in a particular tone or manner. *Achievement*, action, deed. *Patron*, benefactor, one who bestows favours.

What instrument was famous among the ancient Greeks?

The lyre: the invention, or rather discovery, of this instrument is ascribed by them to their most celebrated deities. It is supposed to have originated from the discovery of a dead tortoise, the flesh of which being dried and wasted by the sun, nothing was left within the shell but sinews and cartilages: these, tightened and contracted from their dryness, were rendered sonorous. Some one, Mercury or Apollo, they affirm, in walking along, happening to strike his foot against this tortoise, was so pleased with the sound it produced, that it suggested to him the first idea of a lyre, which he afterwards constructed in the form of a tortoise, and strung it with the dried sinews of dead animals. The stringed instruments already described, were made to give out musical sounds by causing a vibratory motion in their strings by means of the fingers.

*Sinew*, a tendon or cord by which the joints are moved. *Cartilage*, a smooth, solid body, softer than a bone, but harder than a sinew. *Vibratory*, shaking.



Who was Mercury?

The heathen god of eloquence, letters, &c., and the messenger of the other gods.

Who was Apollo?

The god of music, poetry, medicine, and the fine arts.

What is a Tortoise?

A well-known animal, with a thick shelly covering, belonging to the order of reptiles; the species are of two kinds, the sea and the land tortoise; the first named, is called a turtle, and affords delicious food: land tortoises live to a very great age. It is only one sort which furnishes the beautiful shell so prized in Europe. Tortoises are found in many parts of the world. The turtles on the Brazilian shore are said to be so large as to be enough to dine fourscore men: and in the Indian Sea, the shells serve the natives for boats.

What improvement next took place in the formation of the lyre?

A similar effect was then produced by means of horse-hair or silk, strained upon a bow, being drawn across the strings; there are numerous European instruments partaking of the form of the violin, which are but little known in any country besides Italy. In England the violin does not appear to have been known before the sixteenth century. It has long been disputed whether the violin or any instrument of that kind, as now played with a bow, was known to the ancients.

Of what are the Strings composed?

Of either brass or silver wire, &c., but most commonly of catgut.

What is Catgut?

The intestines of sheep or lambs, dried and twisted, either singly or several together. Catgut is also used by watchmakers, cutlers, and other artificers in their different trades. Great quantities are imported into England, and other northern countries, from France and Italy.

Are there no other kinds of instruments besides those already described?

Yes, music and musical instruments have progressively improved, like every other art: and it would be a needless task to enumerate the numbers of instruments of

each kind now in use; many, as for instance the organ, the piano, musical boxes, &c., exceedingly complex and ingenious in their construction, as well as remarkable for the sweetness of their various sounds; some, as the two first named, played with the fingers, and producing any melody or combination of sound at the will of the performer; others, as the musical-box, barrel-organ, &c., producing a particular melody, or a certain number of melodies, by means of machinery, so arranged as to produce those particular sounds, and those only. With these, the performer is not at all indebted to his own musical skill, as he has only to turn the handle which sets the machinery in motion, and the musical-box, or barrel-organ, will continue playing till it has finished the tunes to which it is set.

Upon what principle do these last-mentioned instruments perform?

The barrel-organ and musical-box both play on nearly the same principle, though the former is turned by a handle, and the latter only requires a certain spring to be touched, in order to set it off or to stop it. Their machinery consists of a barrel pricked with brass pins; when the barrel revolves, these pins lift a series of steel springs of different lengths and thicknesses, and the vibration of these springs, when released, produces the different notes.

What is Painting?

The art of representing objects in nature, or scenes in human life, with fidelity and expression, either in oil or water colours, &c.

*Fidelity*, truth, faithfulness. *Oil Colours*, those colours which are mixed up with oil, as the others are with water.

Is not this art of great antiquity?

There is not the slightest doubt of it; but to name the country where it was first practised, or the circumstances attending its origin, is beyond the power of the historian. About a century before the call of Abraham, or even after, Greek and Egyptian tradition tells us of a colony planted at Sicyon, by an Egyptian named Ægialeus, who brought with him the knowledge of painting and sculpture, and founded the earliest and purest school of Greek art. The

walls of Babylon were adorned with paintings of different kinds of animals, hunting expeditions, combats, &c. Allusion to this custom of the Babylonians, of decorating their walls with paintings, is found in the Bible.

*Tradition*, a history or account delivered from mouth to mouth without written memorials; communication from age to age. *Allusion*, reference. *Decorating*, from to decorate, to ornament. *Sicyon*, a kingdom of Peloponnesus, in ancient Greece.

Were the Egyptians acquainted with this art?

It is now little doubted that, although painting and sculpture existed in Egypt, and were probably at their highest condition eighteen centuries before the Christian era, yet, at a still earlier period, these arts were known in the kingdom of Ethiopia; and it is considered likely that the course of civilisation descended from Ethiopia to Egypt. There is, however, no record of any Egyptian painter in the annals of the art; and it does not appear that it ever flourished in that country, or that other nations were much indebted to Egypt for their knowledge of it.

*Era*, age, period. *Ethiopia*, the ancient name of the kingdoms of Nubia and Abyssinia, in Africa. *Annal*, record, history.

Why were the Ethiopians supposed to have introduced the art of painting into Egypt?

Because the existence and exploits of Ethiopian monarchs are now found commemorated on the existing ruins of other cities, and correspond in a remarkable manner with the Jewish and Greek historians.

*Commemorated*, preserved. *Exploit*, action, achievement, deed of valour.

Have we any notice of this art among the Hebrews?

There is no allusion made to the existence of painting among this people, and no proof that it was cultivated among them: it is supposed that the neglect of this art arose from their not being permitted to represent any object by painting.

What progress did the generality of the Eastern nations make in this art?

The art of painting among the Phœnicians, Persians, and other Eastern nations, has been from the earliest ages, low and wretched in the extreme. The Chinese appear,

until a very recent period, to have contented themselves with only so much knowledge of the art as might enable them to decorate their beautiful porcelain and other wares; their taste is very peculiar, and though the pencilling of their birds and flowers is delicate, yet their figures of men and animals are distorted and out of proportion; and of perspective they seem to have but little idea. Latterly, however, a change has taken place in Chinese art, and proofs have been given of an attempt to imitate European skill. The Japanese figures approach more near to beauty than Chinese productions of a similar kind.

*Peculiar*, particular to themselves. *Distorted*, having a bad figure. *Perspective*, the science by which things are ranged in a picture according to their appearance in their real situation.

Who are the Japanese?

The inhabitants of Japan, an empire of Eastern Asia, composed of several large islands. They are so similar in feature, and in many of their customs and ceremonies, to the Chinese, as to be regarded by some as the same race of men. The Japanese language is so very peculiar, that it is rarely understood by the people of other nations. Their religion is idolatrous; their government a monarchy, controlled by the priesthood. The people are very ingenious, and the arts and sciences are held in great esteem by them. In all respects, Japan is a large and interesting empire.

*Monarchy*, a government where the power is vested in a king or emperor.

By what nations was the art of painting practised with great success?

By the Greeks and Romans. Greece produced many distinguished painters, among whom Apelles was one of the most celebrated; he was a native of Cos, an island in the Archipelago, rather north of Rhodes; he flourished in the time of Alexander the Great; and witnessed both the glory and decay of ancient art; the leading features of his style were beauty and grace.

Did painting or sculpture most flourish among the Greeks?

Painting was not at any period so completely national in Greece as its sister art of sculpture; the names of one

hundred and sixty-nine eminent sculptors are recorded, while only fifteen painters are mentioned. Zeuxis, also of Heraclea, was another famous Greek painter, who flourished 400 years before Christ. The Romans were not without considerable masters in this art, in the latter times of the republic, and under the first emperors.

What nation is supposed to have known and practised this art even before the foundation of Rome?

The Etruscans, inhabitants of Etruria, whose acquaintance with the arts has excited great astonishment among those who have most deeply searched into their history, and traced their progress by means of the beautiful specimens of their works still extant. Their early works were not superior to those of other nations; but either from their intercourse with Greece, or the original genius of the people, they had attained considerable eminence in the art of painting and sculpture, &c., before Rome was founded.

What authority is there for this supposition?

Pliny speaks of some beautiful pictures at Ardea and Lanuvium, which were older than Rome; and another author also says that before Rome was built, casting of metals, sculpture, and painting existed among them; and that before any connexion of the Etruscans with Greece. According to some, they were advanced in art even before the Greeks.

Where was Etruria situated?

Etruria was the ancient name of Tuscany, a considerable state of Italy.

Was not the art greatly obscured for some centuries?

The inundation of barbarians, who ruined Italy, proved fatal to painting, and almost reduced it to its primitive state; nor was it recovered in Europe for a long period. The first certain signs of its revival took place about the year 1066, when Greek artists were sent for to adorn several of the cities of Italy. Cimabue, a native of Florence, in the thirteenth century, caught the inspiration of the Greek artists, and soon equalled their works. He was both a painter and an architect.

To what did this revolution in its history give rise?

It caused it to be divided into ancient and modern.

The ancient painting comprehends the Greek and Roman; the modern has formed several schools, each of which has its peculiar character and merit. It was in Italy, however, that the art afterwards returned to its ancient honour, about the middle of the thirteenth century. The first masters who revived the art were greatly surpassed by their scholars, who carried it to the greatest state of perfection, and advanced it, not only by their own noble works, but by the number of pupils they bred up at the schools they had formed.

Who were the principal masters of the Italian school?

The Italian school produced the celebrated Michael Angelo Buonarrotti, who united the professions of painter, sculptor, architect, poet, and musician. He was born at Florence, 1564. Raphael, born at Urbino, in 1483. He is considered to have been the prince of modern painters, and is often styled the divine Raphael: he was also an architect, poet, and sculptor.

Enumerate a few more besides the above-mentioned?

The most illustrious were Leonardo da Vinci, Titian, Correggio, the three Caracci, Guido, Parmegiano, Salvator Rosa, &c. Italy has also since produced a number of others, some original, and some copiers of the great masters.

*Original*, native productions of genius; not copied from another.

Was not Raphael also reckoned as excellent an architect as he was a painter?

He was not only esteemed the best painter in the world, but also the best architect: he was at least so admirable a one, that Leo the Tenth charged him with the building of St. Peter's Church at Rome.

Who was Leo the Tenth?

A Pope of Rome, who was a great lover and patron of learning and the arts. He was born at Florence, in 1475, and died in 1521.

Were there no other schools besides the Italian?

Yes; there were other great masters on this side of the Alps, who had no communication with those of Italy; these founded the German school; the Dutch, Flemish, French, and Spanish schools; and lastly, the English

school, which equals and bids fair to excel them all, in correctness of drawing, effect of colouring and taste of design. Each of these schools has at different times produced several eminent and talented painters.

Give me a list of some of the most celebrated in these several schools.

The great painters of the *German* school were Albert Durer,\* born at Nuremberg, 1471, Holbein, Kneller and Mengs, with several others.

Of the *Dutch* school were Rembrandt, Gerard Dow, Mieris, Ostade, Polemberg, Berghem, and Wouvermans.

Of the *Flemish*, Rubens, Teniers, Jordaens, and Vandyck. The admired painters of the *French* school were Claude, Poussin, Le Brun, and many others.

The *Spaniards* also have had their Murillo, Velasquez, &c. The *Americans*, Washington Allston, Benjamin West, Gilbert Stuart, Copley, and many both living and deceased.

The *English*, Hogarth, Wright, Reynolds, Wilson, West, Northcote, Gainsborough, Morland, Barry, and numbers of others; besides many now living, or but recently dead, whose works may be seen in the annual exhibition of the Royal Academy.

*Exhibition*, sight, show. *Recently*, lately; but a short time back. *Royal*, belonging to a king, kingly. *Academy*, an assembly or society of men, uniting for the promotion of art; the place where sciences are taught; a school. The word is derived from *Academia*, the name of a public school at Athens.

Upon what materials did the ancients paint their works?

Principally upon wood; the boards or tables were prepared with a thin ground of chalk and size of some kind. Linen cloth or canvas was also employed, but there is no evidence of its use before the reign of Nero. Parchment, ivory, and plaster were the other materials.

*Evidence*, testimony, record.

Who was Nero?

One of the Roman emperors, a monster of cruelty, extravagance, and debauchery; he raised a dreadful perse-

\* See Wood Engraving, page 130.

cution against the Christians, in which St. Paul was beheaded, and St. Peter crucified. At last, being deserted by his army and the senate, he destroyed himself, after a reign of fourteen years.

*Debauchery, wickedness.*

Is there not a process by which objects can be represented without the aid of the pencil?

Yes; Photography, or the art of taking correct pictures of any objects in nature, and even landscapes, paintings, and other works of art, by the agency of light on paper, glass, metal, &c. Of this art there are several kinds, which derive their names from the persons who invented them, as the Daguerreotype, from M. Daguerre, &c.

How long is it since this art was discovered?

It dates only a few years back. Its peculiar utility as an instantaneous and accurate copyist is highly valuable to the tourist, the architect, engineer, &c., and even to the painter, the sculptor, and the engraver, as it furnishes the one with pictures of their favourite objects of study, and the other with correct copies of their works.

How is the light made to act upon the above-named materials?

By means of the Camera Obscura, which is made to throw light directly upon a plate or tablet of metal or paper which has been rendered sensitive by different chemical preparations—as a coating of silver washed over with a solution of nitric acid, &c. When thus prepared, it is placed in the camera. In a few moments, surrounding objects are impressed upon it, and it is taken out; but as exposure would quickly obliterate the picture, it has to be plunged into another chemical preparation in order to fix it. Copper is the metal in most use.

Whence is the name photography derived?

From two Greek words signifying *light* and *drawing*. It is also called Heliography, or Sun-drawing, from the same source, *Helio* signifying *sun*.

What is a camera obscura?

Camera obscura, or the *dark chamber*. A method by which the images of external objects are thrown upon a plane or curved surface for the purpose of drawing. It is a small opening made in the shutter of a dark room or



the side of a square box, so that the rays of light fall upon the wall, or a white screen. In the Photogenic Camera the light is made to reflect the required image on the sensitive plate within.

What is Poetry ?

The glowing language of impassioned feeling, generally found in measured lines, and often in rhyme. Most ancient people had their poets ; and among the Hebrews they were called prophets.

*Glowing*, warm, energetic. *Impassioned*, full of passion, enthusiasm. *Rhyme*, the correspondence of the last sound of one verse to the last sound or syllable of another.

Name a few of the ancient poets.

David was an inspired poet of the Hebrews ; Homer one of the earliest poets of the Greeks ; Ossian, an ancient poet of the Scots ; Taliesin, an ancient poet of the Welsh ; and Odin, an early poet of the Scandinavians.

Who were the Scandinavians ?

The inhabitants of Scandinavia, the ancient name of Denmark, Sweden and Norway.

What people are regarded as the Fathers of Poetry ?

The Greeks. Homer was the first and the prince of poets ; and he celebrated the siege of Troy in the *Iliad* and *Odyssey*, two epic poems which have never been surpassed. In the same kind of composition he was followed nine hundred years after by Virgil, in the *Æneid* ; by Tasso, after another fifteen years, in the "*Jerusalem Delivered*." The Greeks also boasted of their Pindar and Anacreon in lyric poetry ; and of Aristophanes, Euripides, Sophocles, and Eschylus, in dramatic poetry.

Did the Romans possess any distinguished poets ?

Yes ; among the epic poets were Ovid and Tibullus ; among dramatists, Plautus and Terence ; of didactic and philosophic poets, Lucretius, Virgil, Horace, and Silius Italicus. All these were so many miracles of human genius ; and their works afford the models of their respective species of composition. Most of the works of the ancients have in sentiment, if not in spirit, been translated into English.

*Miracles*, wonders. *Genius*, talent. *Respective*, separate, different. *Sentiment*, thought, meaning, feeling.

Did not the same revolutions which undermined the Greek and Roman empires, and destroyed learning, the arts and sciences, and the taste for elegance and luxury, prove fatal to poetry ?

It did, and a long night of monkish superstition and ignorance succeeded, in which all kinds of learning were totally neglected ; but in the fifteenth century it revived, together with the arts and sciences, in Italy, so that the first exertions of modern literature were made in that century.

*Monkish*, belonging to monks. *Monk*, one of a religious community, or bound to certain rules and observances. *Superstition*, unnecessary fears or scruples in religion. *Literature*, learning ; skill in knowledge and letters.

What celebrated poets followed this revival ?

In Italy, Dante, Ariosto, Petrarch, and Tasso. These were followed, in France, by Racine, Corneille, Boileau, Voltaire, La Fontaine, and Delille ; and in England by Chaucer, Spenser, Shakspeare, Milton, Dryden, Pope, Thomson, Young, Collins, and Gray. Besides these distinguished names, we have had a great number of poets, as Lord Byron, Coleridge, Wordsworth, Southey, &c. ; Robert Burns, Sir Walter Scott, in Scotland ; Thomas Moore, in Ireland, and many more, whose works would vie with others of any age or country ; as well as several admired living poets, whose meritorious works will be impartially judged and estimated by a future age.

*Impartially*, justice, without prejudice. *Estimated*, valued.

Name a few of the principal American poets.

Washington Allston, Edgar A. Poe, W. G. Willis, Longfellow, Trumbull, &c.

Is not poetry classed under different heads or kinds ?

Yes ; into epic, or historical ; dramatic, or representative—from drama, the name of all compositions adapted to recitation on the stage—in which are displayed, for instruction and amusement, all the passions, feelings, errors, and virtues of the human race in real life ; lyric poetry, or that suited to music, as songs, odes, &c. ; didactic, or instructive ; elegiac, or sentimental, or affecting ; satirical ; epigrammatic, or witty and ludicrous ; and pastoral, or descriptive of country life.

*Historical*, relating to history. *Lyric*, from lyre or harp. *Didactic*,

doctrinal ; relating to doctrines or opinions. *Elegiac*, relating to elegy ; mournful, sorrowful. *Elegy*, a mournful song ; a funeral composition ; a short poem without points or affected elegance. *Satirical*, severe in language ; relating to satire. *Satire*, a poem in which wickedness or folly is censured. *Epigrammatic*, relating to epigram ; a short poem ending in a particular point or meaning, understood but not expressed. *Pastoral*, from *pastor*, a shepherd ; relating to rural employments and those belonging to shepherds.

### What is Astronomy ?

The science which treats of the heavenly bodies, their arrangement, magnitudes, distances, and motions. The term Astronomy is derived from two Greek words, signifying the *law* of the *stars* ; *astron* being the Greek for star.

### Who invented astronomy ?

Its invention has been variously assigned ; and several persons, as well as different nations and ages, have laid claim to it. Belus, King of Assyria ; Atlas, King of Mauritania ; and Uranus, king of the country situated on the shores of the Atlantic Ocean, are all recorded as the persons to whom the world owes this noble science. It is, at least, almost certain that it was known to those nations long before it came into Greece. Its origin is generally fixed in Chaldea. Some attribute its invention to the Hebrews ; others to the Egyptians, from whom they say it passed to the Greeks.

### What country is meant by Mauritania ?

Mauritania is the ancient name of a country in the north of Africa. Chaldea is the ancient name for Babylonia, now called Irak-Arabi, a district of Asiatic Turkey.

### By whom were the heavenly bodies first divided into constellations or groups ?

By the ancients. The phenomena of the heavens were studied in very early ages by several nations of the East. The Chaldeans, the Indians, the Chinese, and the Egyptians have all left evidence of the industry and ingenuity with which their observations were conducted.

*Phenomena*, novel appearances, visible qualities. *Ingenuity*, skillfulness.

### In what manner did they accomplish their undertaking ?

They built observatories,—invented instruments for

observing and measuring with correctness,—separated the stars into different groups or constellations, for the more easily finding any particular star,—gave particular names to most of the moving stars or planets, and noted the period which each took to move through its apparent path in the heavens; and in many other ways the ancients helped to lay the foundations of that mass of astronomical knowledge which men of later ages have brought to more maturity.

*Constellation*, a cluster of fixed stars; an assemblage of stars. *Observatory*, a place so built as to command a view of the heavens.

Who first taught the true system of the universe?

Pythagoras, one of the most distinguished philosophers of antiquity. He is thought to have been a native of Samos, an island in the Archipelago; he flourished about 500 years before Christ, in the time of Tarquin, the last King of Rome. Pythagoras was the first among the Europeans who taught that the earth and planets turn round the sun, which stands immovable in the centre;—that the diurnal motion of the sun and fixed stars is not real, but apparent,—arising from the earth's motion round its own axis, &c. After the time of Pythagoras, astronomy sank into neglect.

*Philosopher*, one who studies philosophy. *Philosophy*, all knowledge, whether natural or moral. The term is derived from the Greek, *philos*, lover, and *sophia*, wisdom.

By whom was it revived?

By the family of the Ptolemies, kings of Egypt, who founded a school of astronomy at Alexandria, which produced several eminent astronomers, particularly one, named Hipparchus. The Saracens, on their conquest of Egypt, became possessed of the knowledge of astronomy, which they carried with them out of Africa into Spain; and thus, after a long exile, it was introduced afresh into Europe.

Did not astronomy from this time make great progress?

Yes; it made considerable advances, being cultivated by the greatest geniuses, and patronised by the greatest princes. The system of the Ptolemies, called the Ptolemaic, had hitherto been used, with some alterations, but Copernicus, an eminent astronomer, born at Thorn, in

Polish Prussia, in 1473, adopted the system which had been taught by Pythagoras in Greece, five or six hundred years before the time of Ptolemy. About the same time with Copernicus flourished Tycho Brahe, born in Denmark, 1546.

*Geniuses*, men gifted with superior mental faculties. *Mental*, belonging to the mind. *Faculties*, powers of doing anything, whether mentally or bodily; abilities, powers of the mind, reason, or memory.

What next greatly forwarded this interesting science?

The introduction of telescopes by Galileo, who by their means discovered the small stars which attend on the planet Jupiter, called the satellites; the various appearances of Saturn; the mountains in the moon; the spots on the sun and its revolution on its axis.

*Satellites*, attendants.

What celebrated astronomer arose in England?

The immortal Sir Isaac Newton, born in 1642, at Woolsthorpe, in Lincolnshire, who has, perhaps, added more to the amount of human knowledge in this path than any one who had before existed. Dr. William Herschel, a native of Hanover, in Germany, born in 1738, likewise made many useful discoveries in astronomy; it was he who first discovered the seventh primary planet, which he named, in honour of King George III., the Georgium Sidus. George III. took him under his immediate patronage, and constituted him his astronomer, with a handsome pension. He resided at Slough, near Windsor, where he died, in 1822.

*Patronage*, support, favour. *Constituted*, appointed to any particular office or rank. *Pension*, yearly allowance of money.

What other circumstances contributed to the advancement of astronomy?

The increasing perfection of our astronomical instruments,—by means of which, the most important and interesting discoveries with regard to the heavens have been made, and are still taking place. It is now supposed that the myriads of the heavenly bodies are all distinct worlds like our own,—each, perhaps, peopled with inhabitants; it is certain, from the observations made by the aid of the telescope, that the moon has its mountains,

valleys, and caverns; and it is even imagined that there may be springs and small rivers.

What are generally meant by the Arts?

By the arts are understood the things of nature subdued and fashioned by human industry, and made to serve the several purposes of mankind; in which sense, *art* stands opposed to *nature*. The word *art* is derived from a Greek word signifying utility, profit. Arts are divided into liberal and mechanical.

What are the Liberal Arts?

The liberal arts are those that are noble and ingenious, or which are worthy of being cultivated without any immediate regard to the pecuniary profit arising from them. They are Poetry, Music, Painting, Sculpture, Architecture, Grammar, the Military Art, and Navigation. The arts which relate to the sight and hearing, are also called Fine Arts, and are chiefly employed in matters of luxury.

*Pecuniary*, relating to money. *Military*, belonging to war and battle.

What do the fine arts usually include?

All those productions of human genius and skill, which are more or less addressed to the sentiment of taste: these are more especially Music, Painting, Sculpture, Architecture, and Poetry.

What are the Mechanical Arts?

Those wherein the hand and body are more concerned than the mind, and which are chiefly cultivated for the sake of the profit attending them—of which kind, are those which furnish us with the necessaries of life, commonly called trades, as carpentry, weaving, printing, &c. The mechanical arts take their name from a Greek word signifying machine, as being all practised by means of some machine or instrument. There are also many different arts, as the art of swimming, diving, writing, &c.

When was the art of Writing invented?

It is supposed that the art was discovered before the Deluge. It was certainly practised long before the time of Moses. There were, doubtless, many steps taken in slow succession before the discovery of alphabetic writing.

What might be the earliest methods?

That which is still employed among the untutored

tribes of North American Indians, namely, the mode of recording events by picture-painting of the rudest description. Picture-painting was gradually converted into the hieroglyphical system of later times, which is still the only kind of writing among the Chinese. It is not known who invented the alphabetic system of writing.

*Deluge*, a flood: the term used in particular to denote that mighty flood of water with which God swept away the first nations of the earth for their wickedness. *Alphabetic*, from *alphabet*, the name of those written signs of language called letters. The word is formed from *alpha*, *beta*, the names of the two first letters of the Greek alphabet. *Untutored*, ignorant, unlearned.

Were not the Egyptians very early acquainted with this art?

Yes, they were acquainted with two or three kinds of writing, as well as the one in which symbolical characters were employed, which was not used in the common occurrences of life. On the contrary, such symbols had something of a sacred character about them, being unknown to the common people, and only to be deciphered by the priests. Obelisks and pyramids were the great national records; and on these the hieroglyphics were constantly used, because unintelligible to the people, until expounded by those who had the exclusive office of explaining them.

*Symbolical*, having the nature of signs or symbols—that is, representations of different things. *Deciphered*, read, understood, made out. *Unintelligible*, not understood. *Expounded*, explained, interpreted.

Were hieroglyphics employed before or after alphabetic writing?

They were undoubtedly employed at first from necessity, not from choice or refinement; and would never have been thought of, if alphabetical characters had been known. This style of writing must be reckoned as a rude effort at improvement, adopted in the early ages of the world, upon the first method of simple picture-writing, or representations of visible objects. Hieroglyphics were employed by the Egyptian priests in after times, as a kind of sacred writing, peculiar to themselves, and serving to give an air of mystery to their learning and religion, though fallen into disuse for other purposes.

When did the introduction of written characters into our own country take place?

Not till after the Roman conquest, and writing was but very little practised by the Britons till after the coming of St. Augustine, in 596. The characters known as Saxon do not appear to have been introduced by the people whose name they bear. It is considered as nearly certain that they merely adopted such as they found in this country in 449, and gradually made such alterations in their form as gave them a distinguishing character. The use of letters in Scotland and Ireland was gained most likely from Roman and Roman-British originals.

Who was St. Augustine ?

A monk of Rome, sent into Britain by Pope Gregory the First, with forty others of the same order, to convert the English Saxons to Christianity. He was the first Archbishop of Canterbury.

What materials were employed by ancient nations in writing ?

The Eastern nations used tables of stone, brass, and wood, so that the characters were graven instead of written in the usual manner. The instrument used in writing on wood, was made of metal, and called a *style*. For stone and brass, &c., a chisel was employed. When the bark and leaves of trees, skins, and other materials of a more pliant nature, superseded the above-named tables, the chisel, and the style or stylus, gave way to the reed and cane, and afterwards to the quill, the *hair* pencil (as now used by the Chinese), and the convenient lead pencil.

*Graven*, inscribed with the graver, a tool used in engraving on stone, &c. *Pliant*, soft, easy, yielding.

Have not the different nations among whom this useful art has been cultivated, adopted several ways of arranging their written characters ?

Yes. The Hebrews, Chaldeans, Syrians, Arabians, and Egyptians, begin each line on the right side, and write towards the left. The Greeks, and all European nations, write from left to right. The natives of China, Japan, and Cochin China, the Corea, &c., write from the top to the bottom of the page.

Where is Cochin China, and the Corea ?

Cochin China is a kingdom situated in Eastern Asia. The Corea is a peninsula of Asia, subject to China.



### What is meant by Science ?

A clear and certain knowledge of anything founded on self-evident principles, or demonstration. The term is more particularly used for a formed system of any branch of knowledge, and is employed in this sense in opposition to art ; it also means any art or species of knowledge, as astronomy, grammar, &c. Chemistry, that is, the knowledge of it, is ranked as a science, but the *practical* part of it is called the art of chemistry ; thus it is sometimes spoken of as a science, sometimes as an art.

*Demonstration*, the strongest degree of proof—such proof, as not only shows the thing proved to be true, but also points out the contrary thing or position to be absurd and impossible: plain evidence of the senses. *Practical*, relating to action, not merely speculative ; applying to the art or method of doing anything ; actual performance,

### What is Chemistry ?

A science which enables us to discover the peculiar properties of natural bodies, either in their simple or compound state, and the elementary or first principles of which they are composed, by the process of analysis and combination. Chemistry treats of those events or changes in natural bodies which are not accompanied by *sensible* motions.

*Compound*, mixed. *Analysis*, a separation of a compound body into the several parts of which it consists.

### Is not the knowledge of chemistry very ancient ?

Chemistry, as far as it regards the discovery of metals in the mine, the digging, separating, and purifying them, is of the highest antiquity ; it is even supposed to have been understood and practised in the antediluvian world. According to Moses, Tubal Cain was the first inventor ; after him, the first chemist we read of, is Moses himself, whose skill in the art is incontestable, from his burning and pulverising the Golden Calf of the Israelites, and giving it to the people to drink ; there being scarcely a more difficult operation in chemistry than that of rendering gold potable, especially in the early stages of the science.

*Antediluvian*, belonging to the world before the flood. *Pulverising*, reducing to powder. *Potable*, drinkable.

What nation appears to have excelled in chemistry in early times?

The Egyptians were no mean proficient in many chemical operations, especially in the arts of working metals, softening ivory, vitrifying flints, and imitating precious stones. Chemistry, however, experienced the common fate of all the arts, at the decline of the Eastern empire.

*Proficients*, those who have made great progress in any art or science.

State the order of its progress.

From Egypt to Arabia, where Geber, a celebrated physician, discovered some most important salts, acids, and metals. In China, they very early had a knowledge of many chemical dyes; and of some metals, salts, and medicinal preparations. Some of their dyes cannot even now be equalled.

How came the art to Europe?

Like every other knowledge, it was almost lost in the ignorance that prevailed during the *dark ages*, or the six first centuries after the breaking up of the mighty and civilised Roman dominions. The Saracens of Arabia, however, during Moorish dominion in Spain, introduced it; and the Crusaders likewise brought some knowledge of it home with them to Spain, whence it spread to Italy, France, and lastly to England.

Who revived it in England?

After having long laid buried, our famous Roger Bacon retrieved it; and from his time to the present day it has gradually progressed to a state of perfection. In former times, the art of chemistry consisted only of the knowledge of working metals, &c.: but in these latter ages, its bounds have been greatly enlarged; and the knowledge of the structure and properties of plants, animals, and minerals, as well as the preparation of medicines, has been added to them. The knowledge of chemistry leads to many interesting and important discoveries, and the arts and manufactures are greatly indebted to its aid; indeed, it is requisite to be a good chemist, in order to attain perfection in many of them.

*Retrieved*, revived, recovered. *Requisite*, necessary.

Name a few of the most celebrated chemists of more modern times.

Bergmann, Glauber, Leibnitz, Liebig, and other Germans. Lavoisier, Berthollet, Chevreuil, and Gay-Lussac, Gossart, &c., in France. In England, Hales, Black, Cavendish, Drs. Dalton, Priestley, Sir Humphrey Davy, and many others living or lately dead. The labours of these celebrated men during the past and present century, united with the researches of scientific men in electricity, chemical action of light, heat, and other phenomena, as Professors Faraday, Daguerre, Brewster, Herschel, &c., have enriched it year by year, and caused it to add more extensively to the arts, comforts, and luxuries of life.

What is the origin of the word?

It is uncertain. It is derived from the Greek *chemeia*, and occurs first in some works of the eleventh century, to denote what we now call alchemy. Some derive it from Ham, son of Noah, one of whose descendants is said to have been the first chemist after the flood; others, from *Chemia*, an ancient name for Egypt, where it was practised. There are, however, many proposed derivations, none throwing any light on its modern signification.

By what other name has chemistry been known?

It was sometimes called *alchemy*, by which is properly understood a refined and mysterious species of chemistry, formerly much practised.

What were its objects?

The discovery of the art of converting other metals into gold, including the search after the "Philosopher's Stone," by which this change was to be effected; and the discovery of a panacea or medicine for the cure of all diseases.

*Panacea*, an universal medicine to cure everything.

What was the Philosopher's Stone?

A substance, for numbers of years eagerly sought for, which was to convert metals, such as lead or mercury, &c., into gold. This unknown substance was called the philosopher's stone, probably on account of the numbers of learned men who engaged in the search after it.

Was this search successful?

No; but the delusion lasted several centuries, notwith-

standing the failures, losses, and disappointments of those engaged in it. Indeed, so severe and ruinous were these, in many instances, that laws were passed to forbid the study. In Germany, many of the alchemists who had the unfortunate reputation of possessing this wonderful stone were imprisoned, and furnished with apparatus till they should have purchased their liberty by making an ounce of gold.

*Delusion*, a cheat, a false representation, an error. *Apparatus*, the whole machine, or set of instruments or tools, &c., by which anything is made, or any object is accomplished.

Was any gold ever produced by this method?

Not a particle: the story of a stone having the property of converting the baser metals into gold being merely an absurd fable; yet, although the pursuits of alchemy were the most preposterous that can be conceived, the ardour with which they were followed, and the amazing number of experiments made in consequence, led to the discovery of many facts to which chemistry is highly indebted.

*Preposterous*, wrong, absurd, foolish; perverted from the ordinary course.

You inform me that chemistry enables us to discover the properties of bodies by means of *analysis* and *combination*; what do these terms imply?

If a chemist wishes to examine the properties of a compound body, he proceeds by analysis—that is, by a separation of the substance to be examined into its constituent parts. The chemical examination of bodies is in general effected by producing a change in the *nature* or *state* of the body under examination. This change is frequently brought about by the addition of some *other* substance which forms a combination with a part of the substance examined, and leaves the remainder in a detached state.

By what *means* do chemists effect a change in the qualities or states of natural bodies?

It is generally effected by means of *heat*, which has a tendency to separate the particles of bodies from each other; or by the *mixture* or *combination* of some other matter with the matter intended to be examined. The mixture of two or more compounds often produces a de-

composition by means of chemical *affinity*, a property which different species of matter have to unite with each other, or with portions of matter of their own species. This is called *elective affinity*. Thus chemists have not only the power of decomposing natural bodies, but of producing by combination various other substances, such as are not found in the kingdom of nature.

What do you mean by *Decomposition*?

In chemical language, it means the dividing of a body into its simple elements.

Give me an example.

Water may be decomposed, and reduced into oxygen and hydrogen, both of them simple substances incapable of further decomposition.

Is not the work of decomposition perpetually going forward?

Yes; and *combustion* is one of the great agents in this work. Combustion converts animal and vegetable substances into water and carbonic acid, by uniting their hydrogen and carbon with the oxygen of the air. These, in time, are again absorbed by vegetables, and again decomposed to set the oxygen at liberty to produce fresh combustions.

Of what use are the two remaining substances—Hydrogen and Carbon?

These are appropriated by the vegetative organs to their growth and nourishment; while the oxygen with which the carbon was combined, is abundantly thrown off to purify the air, and fit it for the respiration of animals. Thus is everything perpetually springing up and again resolving into the general mass, the elementary substances lent by nature for their preservation in existence.

This is *natural* decomposition is it not?

Yes; the other is *artificial*, and effected by various methods and contrivances, as before mentioned, for the production of other substances.

Give me an idea of the mode by which chemists ascertain the *affinity* of bodies, by relating an experiment.

Put a small piece of solid camphor in a phial half filled with diluted alcohol; the camphor will soon be dissolved

in the fluid and the spirit will be clear as at first. This is owing to the affinity which subsists between these two substances. If water be now added (which has a greater affinity for the alcohol than the camphor has) the water will unite with the spirit, and the camphor will separate from the fluid, and fall to the bottom of the phial. In this way the camphor may be nearly all recovered, as at first.

*Phial*, a small glass bottle. *Affinity*, resemblance; connection with.

Give another example.

Water combines readily with alcohol; feebly with ether, hardly at all with oil.

What does the word Nature signify?

In the above sense, the system of the universe; the creation; the bodily works of God. By the kingdom of nature is meant the world and all things in it: nature is divided into three kingdoms, the animal, vegetable, and mineral.

What are the different states of natural bodies?

All bodies are either solid, liquid, or aeriform. By solid bodies are meant those bodies whose parts unite so firmly as to resist impression; by liquid, those substances whose parts do not unite firmly, but have free motion among themselves; by aeriform, fluid substances combined with an additional portion of alcohol, sufficient to give them the gaseous form. Liquid substances are nothing more than solids converted into liquids by heat, a certain increase of which would convert the liquids into vapour. The word aeriform is derived from the Greek for air.

What other name is given to liquids?

They are likewise called fluids; we call the air a fluid, because it flows like a fluid, and light substances will swim in it. It is also known to be fluid, by the easy conveyance it affords to sounds.

*Conveyance*, the means or instrument by which a thing is conveyed.

What is the cause of bodies swimming in fluids?

It is an established law of nature, that all substances will swim if they are lighter than the fluids they swim in. Thus a cork will swim in water, while a stone sinks to the bottom. The cork will not swim in the air, because it is

heavier than the air, though lighter than water; and the stone is not heavier than the *whole* of the water, but more so than a portion of water of its *own bulk*,—and thus it sinks in it. Stones also differ in their weight, or gravity; for instance, some of the asbestos kind are *lighter* than water. Iron, brass, indeed nearly all substances but gold and platina, will float upon mercury, because lighter than that liquid.

What is the cause of bodies being either solid, liquid, or aeriform?

When the principle of *attraction* prevails, it causes them to become solid; when caloric prevails, they become gas. Fluidity is, apparently, a medium between the two.

How is the state of solidity in bodies accounted for?

The particles of all bodies are subject to two opposite powers, *repulsion* and *attraction*; between which they remain in equilibrium. While the *attractive* force remains strongest, the body continues in a state of solidity; but if heat removes the particles, so as to destroy this force, they lose their cohesion, and the body ceases to be solid.

*Equilibrium*, equality of weight, an even balance. *Cohesion*, act of sticking together.

Which is supposed to be the most natural state of all bodies?

Solidity: for by the *combination* of caloric we can reduce most substances to the fluid state, while the greatest number of *liquid* substances take a *solid* form by the loss of heat. Thus, water congeals and forms ice; and even the gases show this disposition to become solid, when they lose their *elasticity* by forming some *combination*.

Explain the terms *Repulsion* and *Attraction*.

Repulsion is a peculiar property in the particles of all matter, which gives them a constant tendency to recede from each other. Attraction is an unknown force, which causes bodies to approach each other. The particles of all bodies possess this property, which causes them to adhere, and preserves the various substances around us from falling in pieces.

Give me some examples of repulsion.

Some bodies have such a *repulsion* to water, that it is

difficult to wet them; some insects can walk, and some birds swim on water, without any of it adhering to them. Place a steel needle carefully on the surface of a basin of water, the *repulsion* of the water will prevent its sinking.

*Repulsion*, the act of driving back.

What is the influence of *attraction*?

It causes electricity and magnetism. Hence the tendency of a steel needle, which has been rubbed a few times near the north pole of a magnet, to that pole, whichever way you may place it. It is this power, also, that causes all bodies to fall towards the earth. If a stone is held in the hand, the earth's attraction is overcome, but as soon as the hand is withdrawn the stone falls. This is called the attraction of gravitation.

Can you produce any other instances of these two powers, in which the chemist is more particularly concerned?

All the operations of chemistry are founded on the force of attraction which nature has established between the *particles* of bodies, and which causes them to unite. The chemist, therefore, employs different means to *destroy* this attraction, and forms fresh substances by means of *new* attractions. Repulsion is of two kinds, sensible and insensible; but it is the latter which is more particularly necessary to the chemist.

Give an instance of each kind of repulsion:

The only kinds that can be exhibited to the senses are those of electricity and magnetism. Of the insensible, the chief example is the repulsion of the particles of caloric among themselves.

*Magnetism* (from *magnet*), the power of the loadstone.

To what would this latter repulsion tend?

To infinite separation; but a *chemical union* which, by a never-failing law of nature, these particles form with every surrounding body, keeps them united. By this law, it appears that caloric *cannot* exist in a detached state.

*Infinite*, unbounded, unlimited; immense, vast.

Is it, then, necessary for chemists to understand the relative nature of all substances?

Yes; because the basis of this science consists in an



*analytical* examination of the works of nature ; an investigation of the properties and uses of all substances we are acquainted with ; and the study of the effects of *heat* and *mixture*, in order that we may find out their general and subordinate laws.

*Analytical* (from *analysis*), that which separates any compound. *Investigation*, act of searching, or tracing out. *Subordinate*, inferior in nature, dignity, or power.

How does a chemist commence his work ?

By arranging all known substances in classes, according to their different sensible or external properties, as weight, colour, smell, taste, &c.

Can all bodies be analysed ?

A few do not admit of it. These are called simple or elementary bodies. In the present day there are sixty-two of these elements, or simple bodies. Out of these, then, the thousands of chemical compounds are made up. Again, some simple bodies form a much larger number of compounds than others. Others occur only in very small number, as constituents of rare minerals.

*Constituent*, that which forms part of a compound.

Is analysis the only work of a chemist ?

No, he creates, but in a secondary sense only, for he has no *real* power of creating chemical compounds. He can bring together two elements that never met before, and the combination which occurs is not effected by man, but from the action of certain properties God has bestowed on these elements. Nevertheless, the chemist's office is a very important one. Few of our most valuable medicines, dyes, pigments, or other substances, are to be found native.

*Pigment* (from *pingo*, to paint), painters' colours.

Name an instance of this.

Glass and soap are in one sense artificial, being found nowhere in nature. Yet, in another, they are natural combinations ; for had there been no laws for their production, man could never have formed them.

Relate a few more of the advantages obtained by a knowledge of chemistry.

The various and wonderful operations of nature, and

the changes which take place in substances around us, are, by its means, revealed to us. Natural history depends on it for the discovery of the minute properties of those substances, of which it describes the *outward* characters. In every manufacture, art, or walk of life, the chemist possesses an advantage over his unskilled neighbour. It is necessary to the farmer and gardener, as it explains the growth of plants, the use of manures, and their proper application; and indispensable to the physician, that he may understand the animal economy, the *effects* which certain *causes* chemically produce, and the nature of vegetable, animal, and mineral poisons. The study is, therefore, an invaluable branch in the education of youth; it is useful not only in the active, but the *moral* life, by laying the foundation of an ardent and inquiring mind; by a knowledge of it, even an every-day walk abroad in the fields can be productive of instruction;—and let us remember, that “Knowledge is Power.”

*Indispensable, necessary, not to be done without.*

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